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NATIONAL DAM INSPECTION REPORT. INDIAN MOUNTAIN LAKE DAM (NDI I--ETC(U)
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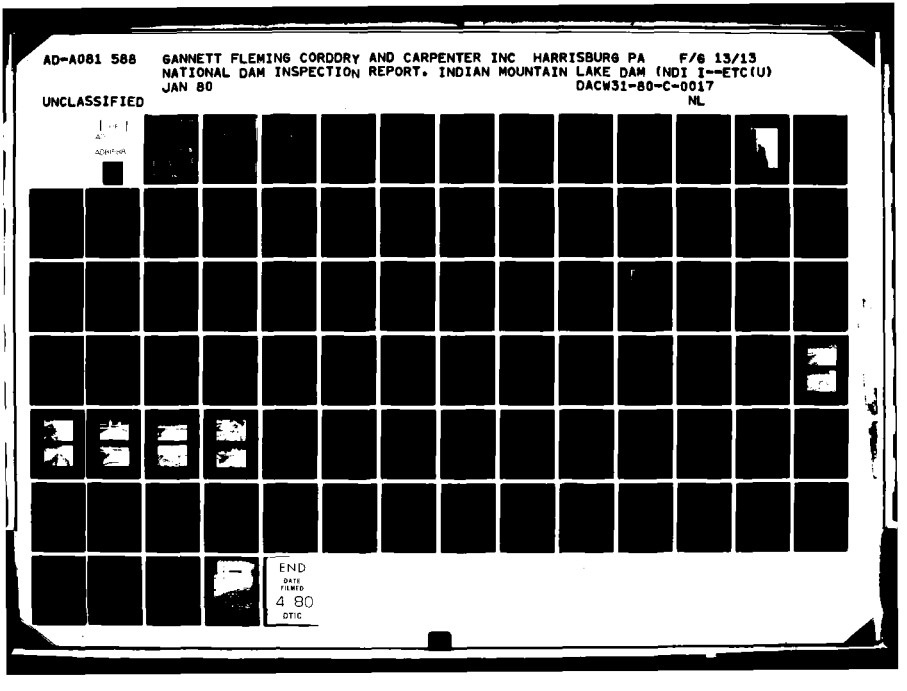


DELAWARE RIVER BASIN
MUD RUN, MONROE COUNTY

LEVEL II

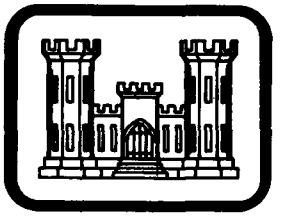
PENNSYLVANIA

INDIAN MOUNTAIN LAKE DAM

NDI ID NO. PA-00783
DER ID NO. 45-227

INDIAN MOUNTAIN LAKES CIVIC ASSOCIATION, INC.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JANUARY 1980

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DELAWARE RIVER BASIN

MUD RUN, MONROE COUNTY

PENNSYLVANIA

(6) National Dam Inspection Report.

INDIAN MOUNTAIN LAKE DAM

(NDI ID Number PA-00783,
DER ID Number 45-227),

INDIAN MOUNTAIN LAKES
CIVIC ASSOCIATION, INC.

Delaware River Basin, Mud Run, Monroe County, Pennsylvania.
DACW31-80-C-0017

PHASE I INSPECTION REPORT.

NATIONAL DAM INSPECTION PROGRAM

(12) 83

Prepared by

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

MUD RUN, MONROE COUNTY

PENNSYLVANIA

INDIAN MOUNTAIN LAKE DAM

NDI ID No. PA-00783
DER ID No. 45-227

INDIAN MOUNTAIN LAKES
CIVIC ASSOCIATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1980

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APPENDICES

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Indian Mountain Lake Dam NDI ID No. PA-00783 DER ID No. 45-227
Size:	Small (13 feet high, 840 acre-feet)
Hazard Classification:	High
Owner:	Indian Mountain Lakes Civic Association, Inc. Albrightsville, Pa. 18210
State Located:	Pennsylvania
County Located:	Monroe
Stream:	Mud Run
Date of Inspection:	16 November 1979

Based on visual inspection, available records, calculations, and past operational performance, Indian Mountain Lake Dam is judged to be in fair condition. The existing spillway can pass the Probable Maximum Flood (PMF) with 0.6 foot of freeboard. The spillway capacity is rated as adequate. This analysis is predicated upon the proper functioning (failure) of the flashboards on the spillway crest. If the low areas at the top of the embankment were raised, the freeboard would increase to 1.2 feet. Needed repairs have not been made to some features of the dam. There is no functional outlet works at the dam.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Install a gate operating mechanism for the outlet works gate and construct a properly designed outlet structure at the outlet works.

(2) Repair the eroded areas on the upstream slope and provide properly designed slope protection for the upstream slope.

(3) Perform an investigation and study to determine measures required to prevent further depressions from occurring behind the spillway walls, while at the same time ensuring the integrity of the spillway walls and embankment. Fill in the existing depressions and take other appropriate action as required.

(4) Perform an investigation and study to determine if any foundation damage has occurred as a result of the excessive seepage at the spillway. The study should also determine the cause of the seepage and address measures required to reduce the seepage to an acceptable amount. Take appropriate action as required.

(5) Repair the slough on the downstream slope of the embankment. After repairs are made, monitor the area. Should any change in the area occur, take appropriate action as required.

(6) Remove trees and brush on or near the embankment.

(7) Fill in the low areas at the top of the embankment.

(8) Until investigations, studies, and remedial work are completed, the Owner should monitor the condition of the dam and appurtenant structures. Take appropriate action as required should any changes in conditions occur.

All investigations, studies, designs, and supervision of repairs and construction should be performed by a professional engineer experienced in the design and construction of dams. Monitoring programs should also be performed or supervised by a professional engineer.

In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Indian Mountain Lake Dam. This system should address the effects of a rise in the downstream depth of flow due to the proper functioning (failure) of the flashboards.

(2) Provide round-the-clock surveillance of Indian Mountain Lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

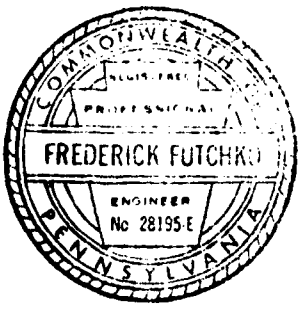
(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

INDIAN MOUNTAIN LAKE DAM

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.



FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 11 February 1980

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF
ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 29 Feb 1980

INDIAN MOUNTAIN LAKE DAM

Overview

DELAWARE RIVER BASIN

MUD RUN, MONROE COUNTY

PENNSYLVANIA

INDIAN MOUNTAIN LAKE DAM

NDI ID No. PA-00783
DER ID No. 45-227

INDIAN MOUNTAIN LAKES
CIVIC ASSOCIATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Indian Mountain Lake Dam is a zoned, earthfill embankment. The design height of the dam is 13 feet at its maximum section. The dam is 695 feet long, including the spillway. The spillway is a concrete gravity weir located near the left abutment of the dam. It is 110 feet long and its crest is 5.7 feet below the design top elevation of the dam. Flashboards that are 1.7 feet high are provided along the spillway crest. The outlet works is located near the middle of the

embankment to the right of the spillway. It consists of a 24-inch diameter steel pipe with a concrete headwall and gate at the upstream end and a concrete outlet structure at the downstream end. The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is presented in Appendix F.

b. Location. The dam is located on Mud Run approximately 4.9 miles east of Albrightsville, Pennsylvania. Indian Mountain Lake Dam is shown on USGS Quadrangle, Blakeslee, Pennsylvania, with latitude N41° 00' 15" and longitude W75° 30' 25", in Tunkhannock Township, Monroe County, Pennsylvania. The upstream end of the reservoir is shown on USGS Quadrangle, Pocono Pines, Pennsylania. The location map is shown on Plate E-1 in Appendix E.

c. Size Classification. Small (13 feet high, 840 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Indian Mountain Lake Dam (Paragraphs 3.1f and 5.1c(4)).

e. Ownership. Indian Mountain Lakes Civic Association, Inc., Albrightsville, PA 18210. The president of the Association is Robert N. Mueller. Correspondence should be sent directly to the Association.

f. Purpose of Dam. Recreation.

g. Design and Construction History. The dam was designed in 1959 by Leo A. Achterman, Jr., Consulting Engineer of Stroudsburg, Pennsylvania. The design is shown on Plate E-2 in Appendix E. The permit to construct the dam was issued in January 1960. Construction started in the spring of 1960 under the supervision of Mr. Achterman. The Contractors were G. H. Litts and Son, and Paul L. Edinger. The dam was completed in August 1960.

In 1962, Mr. Achterman designed modifications to the dam which are shown on Plate E-3 in Appendix E. The modifications consisted of raising the embankment by approximately 2 feet, raising the spillway approach and exit channel walls near the weir by about 2 feet, and providing flashboards along the spillway crest. The

permit to construct these modifications was issued in May 1962. Mr. Achterman stated that, although he was not associated with the construction of the work, he believed that the Contractor was either Getz and Sons or Leon Keiper. Other data concerning these modifications are not available.

In 1964, Mr. Achterman designed deadmen to strengthen the left spillway approach wall (Plate E-4). Construction of an adjacent structure and the associated regrading required that the wall be strengthened.

The local residents refer to the impoundment as the "Big Lake." There are other minor impoundments downstream that are within the Indian Mountain Lakes Development.

h. Normal Operational Procedure. The reservoir is normally maintained at the top of the flashboards with excess inflow discharged over the spillway.

1.3 Pertinent Data.

a. Drainage Area. (square miles)	2.8
b. Discharge at Damsite. (cfs)	
Maximum known flood at damsite	Unknown.
Outlet works at maximum pool elevation	60
Spillway capacity at maximum pool elevation	4,840
c. Elevation. (feet above msl)	
Top of dam (existing)	1799.1
Top of dam (design)	1799.7
Maximum pool	1799.1
Normal pool (flashboard crest)	1795.7
Spillway Crest	1794.0
Upstream invert outlet works	1788.5
Downstream invert outlet works	1787.1
Streambed at toe of dam	1787.1
d. Reservoir Length. (miles)	
Normal pool	0.72
Maximum pool	1.42
e. Storage. (acre-feet)	
Spillway crest	203
Normal pool	313
Maximum pool (design)	840

f.	Reservoir Surface. (acres)	
	Spillway crest	49
	Normal pool	81
	Maximum pool (design)	190
g.	Dam.	
	Type	Zoned earthfill.
	Length (feet)	585
	Height (feet) (design)	13
	(existing)	12
	Topwidth (feet) (design)	10
	(existing)	12
	Side Slopes	
	Upstream (design)	1V on 3H
	(existing)	1V on 1.8H
	Downstream	1V on 3H
	Zoning	Clay core with hardpan.
	Cutoff	Clay core founded on "impervious" foundation.
	Grout Curtain	None.
h.	Diversion and Regulating Tunnel.	None.
i.	Spillway.	
	Type	Concrete gravity weir with near-ogee crest. Flashboards are provided on the crest.
	Length (feet)	110

i.	Spillway. (Cont'd.)	
	Elevations	
	Weir crest	1794.0
	Flashboard crest	1795.7
	Upstream channel	Reservoir.
	Downstream Channel	Concrete paved apron extending to grouted stone exit channel and thence to natural stream.
j.	Regulating Outlets	
	Type	24-inch diameter steel pipe.
	Length (feet)	69
	Closure	Gate at upstream end (see text).
	Access	None at present (see text).

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. The available data are summarized in Appendix A. The Pennsylvania Water and Power Resources Board reviewed the original design and ordered minor revisions in the design. A report of their review is on file, as are some of the original design computations. The flashboard design is available for the 1962 modification to the dam. No analysis by the Commonwealth for this modification is available.

b. Design Features. The dam and appurtenances are described in Paragraph 1.2a. The design features are shown on the Photographs in Appendix C and on the Plates in Appendix E. Plate E-2 shows the original dam prior to its modification in 1962. Plate E-3 shows the modifications made in 1962 to the dam. Plate E-4 shows the 1964 modifications to the dam.

Although not indicated on the Plates, the design engineer believed that wire-mesh reinforcing was placed in the spillway wall, spillway apron, and outlet works concrete.

c. Design Considerations. Specific design considerations are addressed in Section 5 and Section 6.

2.2 Construction.

a. Data Available. The only data available are the recollections, reported verbally, of the design engineer, who also supervised the original construction. No data are available for the 1962 or 1964 modifications to the dam.

b. Construction Considerations. The design engineer reported that no special problems were encountered during the original construction except in the spillway area, where springs were encountered. He reported that, as construction changes, drain material was placed beneath the spillway apron, drain holes were added to the spillway apron and spillway walls, and drain

material was added behind the spillway walls. He did not recollect the details of the drain placement. The available data raises no special concerns about the construction of the dam.

2.3 Operation. There are no formal records of operation. There is no evidence of any formal inspections of the dam having been made after its construction.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania. The engineer who designed the original dam and the subsequent modifications provided additional data verbally. The Owner made available the maintenance supervisor for information during the visual inspection.

b. Adequacy. Design data and other engineering data are somewhat limited. The assessment is based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

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SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is fair, with deficiencies as noted herein. The locations of deficiencies are shown on Exhibit B-1 in Appendix B. Survey data acquired during this inspection are presented in Appendix B. On the day of the inspection, the pool was 0.1 foot above the top of the flashboards.

b. Embankment. The embankment is in fair condition. The downstream slope has a shallow slough which extends for about 10 feet along the top adjacent to the spillway (Photograph A). Small trees are growing sporadically over the slope, especially near the right abutment (Photograph B). The upstream slope is covered with brush growing sporadically except at areas where erosion has occurred (Photograph C). The erosion is severe and especially bad at the junction of the embankment and the right spillway wall (Photograph E). At this area, the erosion has proceeded almost one-half way across the top of the dam. Except for the vegetation, no slope protection was observed on the upstream slope.

There was a flow of about 10 gpm along the downstream toe between the outlet works and the right abutment. This was determined to be surface runoff. Although this runoff could have obscured seepage through the dam, any such seepage would have been minor.

The survey performed for this inspection (Appendix B) revealed that the top of the embankment is above its design elevation except adjacent to both sides of the spillway, where it is a maximum of 0.6 foot below design elevation. The survey also revealed that the downstream embankment slope is in accordance with the design, that the topwidth is generally about 2 feet wider than the design, and that the upstream slope is 1V on 1.8H, which is considerably steeper than the 1V on 3H design slope.

c. Appurtenant Structures. The spillway is in fair condition. Flashboards extend along the crest of the weir. There was a slight flow over the flashboards, which hindered visual inspection. No deficiencies were observed at the concrete weir. Only a few flashboard pins could be inspected; they appeared to be in accordance with the

design (Appendix A). The concrete spillway apron immediately downstream of the weir is cracked at one location. Because the apron was submerged, the width and extent of the crack could not be determined. Drain holes are provided in the apron. Immediately adjacent to the crack, one drain hole was discharging such that the water flowing from it rises 2 to 3 inches above the flow in the apron (Photograph F). The two other drain holes that are immediately adjacent to this drain hole also have a significant amount of flow. There are many shrinkage cracks at the spillway walls both upstream and downstream of the weir (Photographs F and H). No expansion or contraction joints were observed in the walls. At a few small areas on top of the spillway walls, minor peeling of concrete was observed. The spillway walls upstream and downstream of the weirs have drain holes extending through them. The earthfill behind the walls is depressed at areas adjacent to the drain holes (Photograph H). Two plastic pipes, which are believed to be drains from adjacent buildings, extend underground to behind the left spillway wall, where their ends are exposed because of depressions in the earthfill.

The outlet works is in poor condition. Although available drawings indicate that the outlet works has a gate, no evidence of the gate operating mechanism was observed. The Owner's maintenance supervisor believed it was submerged, but said that he had never seen it. No deficiencies were observed at the steel conduit. The outlet works structure has failed structurally. The left sidewall has been removed and is lying about 30 feet downstream on the overbank of Mud Run. The right sidewall is tilted and separated from the headwall (Photographs I and J). There are structural cracks in the headwall (Photograph J).

e. Reservoir Area. The watershed area is swampy and covered mostly with scrub brush. Development in the watershed is minor. The most significant development is the homes of Indian Mountain Lakes Development. Slopes in the watershed are mild.

f. Downstream Channel. Mud Run extends downstream from the dam through part of the Indian Mountain Lake Development. The overbanks have very thick and tall brush growing on them. Eleven dwellings were observed near the stream downstream from the dam. One of the dwellings is about 800 feet downstream from the dam. The others are within a reach which extends from 1 to 2 miles downstream from the dam. The downstream area is shown on Exhibit D-1 in Appendix D.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the top of the flashboards, Elevation 1795.7, with excess inflow discharging over the flashboards. The gate at the outlet works is normally closed.

4.2 Maintenance of Dam. The Indian Mountain Lakes Maintenance Supervisor is responsible for the maintenance of the dam. Major repairs require approval by the Board of the Civic Association. The dam is visited daily except in winter, when it is visited at least every two weeks. Brush is reportedly cut every three weeks. Formal inspections of the dam are not made.

4.3 Maintenance of Operating Facilities. There are no functional operating facilities at the outlet works. There are no formal maintenance procedures for the flashboards.

4.4 Warning Systems in Effect. The Owner's Maintenance Supervisor stated that there was no emergency operation and warning plan. He stated that the dam is monitored frequently during periods of heavy rain.

4.5 Evaluation of Operational Adequacy. Judging by the deficiencies observed during the visual inspection, the maintenance of the dam is inadequate. Inspections are necessary to detect hazardous conditions at the dam. Functional operating facilities at the outlet works are necessary so that the pool level can be drawn down for repairs or during emergency conditions. Although the present condition of the flashboards is good, minor changes could prevent them from functioning properly. Proper maintenance of the flashboards is necessary to ensure that they function properly in event of a flood. The Owner should be aware that the correct functioning (failure) of the flashboards can result in significant and rapid rises in downstream depths of flow. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life downstream should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The hydrologic and hydraulic design data available for review consist of the Pennsylvania Water Power and Resources Board analysis of the original spillway capacity. The capacity was determined to be 3,340 cfs, which was greater than the Curve "C" discharge of 3,110 cfs that was required by the Commonwealth. The original design for the exit channel hydraulics is available and is included in Appendix A.

The dam was modified in 1962. The flashboard structural design computations are available and are included in Appendix A. No other hydraulic design data are available for this modification.

The drainage area of 2.84 square miles used in this report is based on recent USGS mapping; it is slightly greater than the drainage area of 2.66 square miles used for the original design.

b. Experience Data. The maintenance supervisor stated that in his recollection the largest flood occurred in 1976, when water in the spillway apron area was about 1.5 feet deep. It is beyond the scope of this report to estimate the discharge coincident with this depth.

c. Visual Observations.

(1) General. The visual inspection of Indian Mountain Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low areas on the top of the dam reduce the spillway capacity.

(3) Appurtenant Structures. No hydraulic deficiencies were observed at the spillway. The design of the flashboards (Appendix A) was checked and found to be satisfactory (Appendix D). The effects of the flashboards on the spillway discharge are included in the analysis described hereafter. The location of the outlet works gate provides upstream cutoff for the conduit. Because

there is no gate operating mechanism, the gate is presently inoperable, which is considered a serious deficiency because there is no means of drawing down the reservoir in case of an emergency. The design engineer stated verbally that it was his understanding that the gate operating mechanism had been damaged by ice and that the Owner was planning to repair it. He stated that he was not involved with the repairs. The maintenance supervisor did not mention any proposed repairs. He did not recollect ever having seen the gate operating mechanism.

(3) Reservoir Area. No conditions were observed in the watershed that might present a significant hazard to the dam.

(4) Downstream Conditions. No conditions were observed downstream from the dam that might present a significant hazard to the dam. Although the design capacity of the exit channel is less than the spillway capacity, the channel is sufficiently far from the dam that its overtopping would not be a hazard to the embankment. There are at least 11 dwellings that could be flooded by a failure of the dam. The thick growth on the overbanks of Mud Run would retard flow, therefore creating a higher depth of water than would normally be expected to occur. Because of the possibility of flooding dwellings, a high hazard classification is warranted for Indian Mountain Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE) for the size (Small) and hazard potential (High) of Indian Mountain Lake Dam, the Spillway Design Flood (SDF) is between one-half of the Probable Maximum Flood (PMF) and the PMF. Because of the downstream conditions, the PMF is selected as the SDF for Indian Mountain Lake Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of the dam is based on existing conditions and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Indian Mountain Lake Dam can pass the PMF with 0.6 foot of freeboard. If the low areas at the top of the dam were filled in, the freeboard would increase to 1.2 feet.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because the dam can pass the PMF, the spillway capacity is rated as adequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Indian Mountain Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. Brush and trees growing on the embankment are undesirable because their roots can damage the embankment. The design drawings shown on Plates E-2 and E-3 indicate that the embankment, except for the clay core, was to be constructed of "hardpan." The material appeared to be a silty sand. These design drawings also indicate that riprap was to be extended on the raised portion of the upstream slope. No evidence of the riprap was observed. The soil used to construct the embankment is apparently readily erodable. The combination of foot traffic and wave action has probably caused the erosion. The steeper-than-design upstream slope has probably contributed to the erosion. This slope is probably steeper than design because of the overbuild provided, as is evident from the existing profile of the top (Appendix B). During high pool conditions, the erosion could increase rapidly and threaten the integrity of the embankment. The shallow slough on the downstream slope may have been caused by the combination of poor compaction and the passage of mowing equipment on the slope. It is not a significant hazard if no further movement occurs.

(3) Appurtenant Structures. The spillway structures are founded on overburden. As noted in Paragraph 2.2b, drain material was placed beneath the spillway apron to relieve flow from springs. Details on Plate E-4 indicate that there are no cutoff facilities, such as a key, beneath the weir. Considering that the net head differential between the reservoir and the apron is about 5 feet, the amount of localized seepage is excessive. The exit seepage gradient may be near critical. The excessive seepage could be caused by a pervious stratum near the drain hole, by flow from springs, or by a subsurface channel that is eroded beneath

the apron. The crack in the apron that was observed near the seepage could have been caused by settlement or uplift. If it was caused by settlement, it would not be of concern. However, if it was caused by uplift, there would be concern for the integrity of the apron.

The shrinkage cracks in the spillway walls probably result from the lack of expansion or contraction joints. They do not present a hazard to the dam at present, but they have the potential to start spalling. This would be a problem if neglected for a long period. The peeling of concrete at the tops of the walls is minor and not of immediate concern.

The depressions behind the spillway walls are of concern. Details are not available for the filter behind the walls. It is believed that either the filter has washed through the drain holes or fines in the soil have washed through the filter. Flows from the plastic drain pipes have probably worsened the situation. Generally, drain holes are not placed in spillway walls upstream of the weirs. This negates the effect of the wall in acting as an impervious barrier and provides a short seepage path between the reservoir and the area downstream from the spillway. The condition is potentially serious during periods of high flow. This condition may have exacerbated the erosion observed at the junction of the embankment and the right spillway wall; some of the embankment may have washed through the drain hole.

Conditions at the outlet works are of concern. The lack of a gate operating mechanism is evaluated in Section 5. The outlet structure has failed structurally. The sidewalls (Photograph J) dc not appear to have been constructed in accordance with the design drawings shown on Plate E-3. The increased load on the headwall, which was caused by the 1962 modification to the dam, is the probable cause of cracking. The entire headwall and sidewalls are unable to support the loads placed against them.

b. Design and Construction Data. The design engineer reported that the only stability analysis performed during design was of an elementary and approximate nature. The tops of the flashboards on the spillway weir are only 4.7 feet above the spillway apron. A review of the spillway section shown on Plate E-3 indicates that the structures should be stable for the anticipated loads.

c. Operating Records. There are no formal records of operation. There are no inspection records to aid in the analysis of the observed deficiencies.

d. Postconstruction Changes. The 1962 and 1964 modifications to the dam are assessed in Paragraph 6.1a.

e. Seismic Stability. Indian Mountain Lake Dam is located in Seismic Zone 1. Earthquake loadings are not considered to be significant for small dams located in Zone 1 when there are no readily apparent stability problems at the dam. Since there were no readily apparent stability problems at the dam, its ability to resist earthquake loadings is assumed to be adequate.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on visual inspection, available records, calculations, and past operational performance, Indian Mountain Lake Dam is judged to be in fair condition. The existing spillway will pass the PMF with 0.6 foot of freeboard. If the low areas at the top of the dam were filled, the freeboard would increase to 1.2 feet. This analysis is predicated upon the proper functioning (failure) of the flashboards on the spillway crest. The spillway capacity is rated as adequate.

(2) Needed repairs have not been made to some features of the dam.

(3) There is no functional outlet works for the dam.

(4) A summary of the features and observed deficiencies is listed below.

Feature and Location	Observed Deficiencies
Embankment:	Brush and trees; lack of slope protection on upstream slope; severe erosion on upstream slope; low areas on top; slough on downstream slope.
Spillway:	Depressions behind walls; shrinkage cracks and peeling along walls; excessive flow through drain hole in apron; crack in apron.

Feature and Location	Observed Deficiencies
Outlet Works:	No operating mechanism; headwall and sidewalls failed structurally.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Install a gate operating mechanism for the outlet works gate and construct a properly designed outlet structure at the outlet works.

(2) Repair the eroded areas on the upstream slope and provide properly designed slope protection for the upstream slope.

(3) Perform an investigation and study to determine measures required to prevent further depressions from occurring behind the spillway walls, while at the same time ensuring the integrity of the spillway walls and embankment. Fill in the existing depressions and take other appropriate action as required.

(4) Perform an investigation and study to determine if any foundation damage has occurred as a result of the excessive seepage at the spillway. The study should also determine the cause of the seepage and address measures required to reduce the seepage to an acceptable amount. Take appropriate action as required.

(5) Repair the slough on the downstream slope of the embankment. After repairs are made, monitor the area. Should any change in the area occur, take appropriate action as required.

(6) Remove trees and brush on or near the embankment.

(7) Fill in the low areas at the top of the embankment.

(8) Until investigations, studies, and remedial work are completed, the Owner should monitor the condition of the dam and appurtenant structures. Take appropriate action as required should any changes in conditions occur.

All investigations, studies, designs, and supervision of repairs and construction should be performed by a professional engineer experienced in the design and construction of dams. Monitoring programs should also be performed or supervised by a professional engineer.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Indian Mountain lake Dam. This system should address the effects of a rise in the downstream depth of flow due to the proper functioning (failure) of the flashboards.

(2) Provide round-the-clock surveillance of Indian Mountain lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: INDIAN MOUNTAIN LAKE

NDI ID NO.: PA-00783 DER ID NO.: 45-227

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE AVAILABLE DRAWINGS ARE IN APPENDIX E.
REGIONAL VICINITY MAP	SEE PLATE E-1
CONSTRUCTION HISTORY	CONSTRUCTED 1960 MODIFIED 1962
TYPICAL SECTIONS OF DAM	SEE PLATES E-2 AND E-3
OUTLETS: Plan Details Constraints Discharge Ratings	SEE PLATES E-2 AND E-3

A-1

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	WATER AND POWER RESOURCES BOARD (PENNDER) ANALYSIS IN FILES
GEOLOGY REPORTS	NONE
DESIGN COMPUTATIONS: Hydrology and Hydraulics (H&H) Dam Stability Seepage Studies	H&H - SEE SHEETS INCLUDED AT END OF APPENDIX ORIGINAL DESIGN - 3340 CFS GREATER THAN PENNDER CURVE C OF 3110 CFS. STABILITY - DESIGN ENGINEER REPORTS THAT ANALYSIS WAS BRIEF AND ELEMENTAL. SEEPAGE - NONE
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	AVAILABLE DATA IS ON PLATE E-2
POSTCONSTRUCTION SURVEYS OF DAM	NONE

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	DATA NOT AVAILABLE
MONITORING SYSTEMS	NONE
MODIFICATIONS	1962 - RAISED 1964 - LEFT SPILLWAY WALL STRENGTHENED.
HIGH POOL RECORDS	NONE
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None
SPILLWAY: Plan Sections Details	See Plates E-2, E-3, and E-4
OPERATING EQUIPMENT: Plans Details	No details available. Gate reported to be Low head Sluice Gate.
PREVIOUS INSPECTIONS Dates Deficiencies	None

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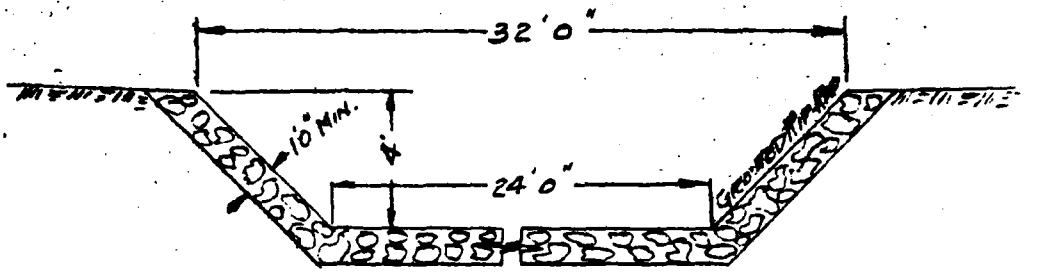

REVISED WASTEWAY SECTION
PROPOSED DAM OF
LEON ROSS & JACK COHEN
TUNKHANNOCK TWP., MONROE Co.
NOT TO SCALE — 20 NOV. 1959.

$$Q = a \times \frac{1.486}{n} \times R^{2/3} \times S^{1/2}$$

$a = \frac{32+24}{2} \times 4 = 112\ Ft^2$ W.P. $= 24 + 1.414(4)(2) = 35.312$ ft.

H.R. $= \frac{112}{35.312} = 3.172$ $S = 3.125\%$ $n = 0.02$

$Q = 112 \times \frac{1.486}{.02} \times 3.172^{2/3} \times 0.03125^{1/2}$

$= 112 \times 74.3 \times 2.158 \times 0.1761 = 3162$ cfs $>$ 3110 cfs ER CK.

NOTES CONCRETE WASTEWAY TO BE MODIFIED TO CONFORM WITH REVISION ABOVE.

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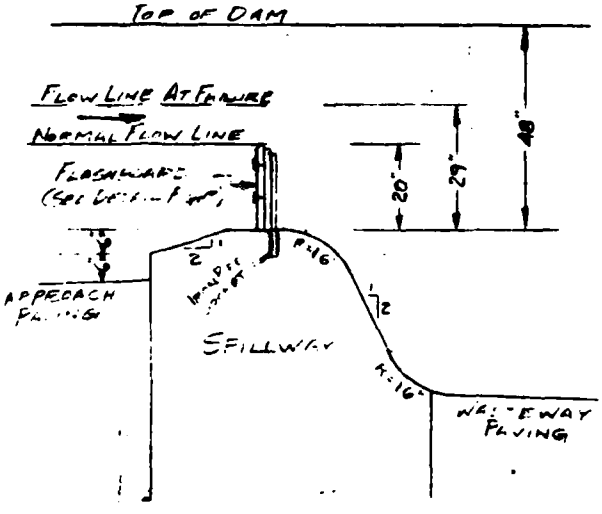
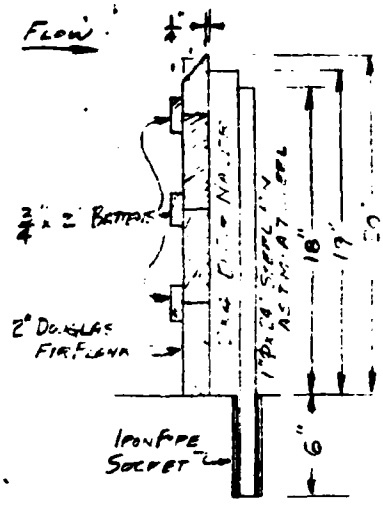
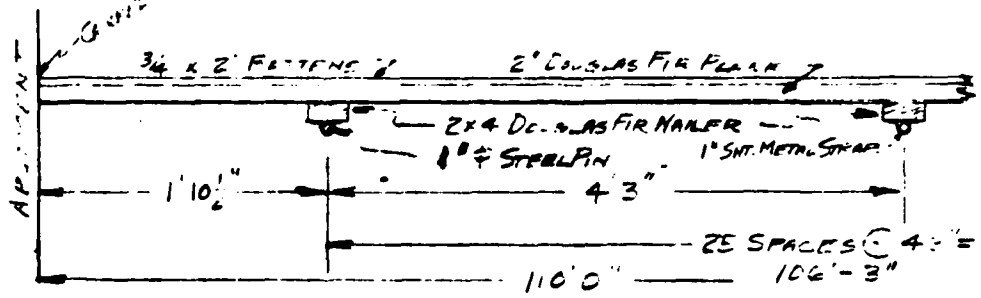
PHONE MA 1-7670



ELEVATION - PROPOSED FLASHBOARD
SCALE: 3/8" = 1'-0"



DETAIL - ELEVATION
PROPOSED FLASHBOARDS
SCALE: 1 1/2" = 1'-0"



NOTES: STEEL PINS - A.S.T.M. A-7 STEEL ULTIMATE STRESS 60,000 PSI -
BATTENS ATTACHED WITH 60D NAILS -
PLANKS NAILED TO NAILERS -
NAILERS LOOSELY MOUNTED TO PINS AT TOP ONE INCH WIDE SHEET METAL STRAPS - 1/4 DIAMETER U SHAPE.

SCALE: 1" = 1'-0"

PLAN
PROPOSED FLASHBOARDS
POSS AND COHEN, INC.
TOBYHANNA TWP. MONROE CO.
SCALE: AS NOTED 3/26.1

DESIGN CALCULATION SHEET
PROPOSED FLASHBOARDS
ROSS AND COHEN DAM - PERMIT 45-227

IT IS PROPOSED TO ERECT FLASHBOARD OF 2" (NOMINAL) WOOD PLANK, 20 INCHES HIGH, OVER EXISTING HEIGHT OF PERMANENT CONCRETE SPILLWAY. THE PLANK WILL BE NAILED TO 2x4 NAILERS LOOSELY MOUNTED ON ONE INCH DIAMETER STEEL PINS SPACED 4'3" ON CENTERS ACROSS THE LENGTH OF THE SPILLWAY. THE STEEL PINS WILL SLIP INTO IRON PIPE SOCKETS GROUTED INTO HOLES DRILLED SIX INCHES INTO THE TOP OF THE SPILLWAY. A TOTAL OF 26 PINS WILL BE USED. THE PINS WILL BE MADE OF TYPE A.S.T.M. A-7 STEEL WITH A DESIRABLE ULTIMATE STRESS OF 60,000 PSI BUT AN ABSOLUTE ULTIMATE STRESS OF 72,000 psi. THE FLASHBOARD WILL FAIL BY THE FAILURE OF THE PINS IN BENDING.

$S = .785398\,R^3 = .785398\,(.5)^3 = .098175$ in.^{3}

$M = FS$ @ ULTIMATE 60 K/in.^{2} $M =$ 5890 in lb ALLOWABLE

@ ULTIMATE 72 K/in.^{2} $M =$ 7069 in lb ALLOWABLE

PINS SPACED 4'3" O.C.

AT NORMAL FULL LINE $M_{ACTING} = \frac{20}{12} \times 62.4 \times \frac{20}{12} \times \frac{1}{2} \times \frac{20}{3} \times 4.25 =$ 578 in lb/ft x 4.25 ft

$= 2456.5$ in lb./pin OK

AT 29 INCHES OVER SPILLWAY FREEBOARD 19"

$M_{ACTING} = \left[\left(\frac{29}{12} \times 62.4 \times \frac{29}{12} \times \frac{1}{2} \times \frac{29}{3}\right) - \left(\frac{9}{12} \times 62.4 \times \frac{9}{12} \times \frac{1}{2} \times \left\{\frac{9}{3} + 20\right\}\right)\right] \times 4.25 =$

60,000 PSI DESIRABLE ULTIMATE

1410 in lb./ft x 4.25 ft. =

5992.5 in lb/pin > 5890 in lb

WILL FAIL @ 60 K/in.^{2}

AT 32 INCHES OVER SPILLWAY FREEBOARD 16"

$M_{ACTING} = \left[\left(\frac{32}{12} \times 62.4 \times \frac{32}{12} \times \frac{1}{2} \times \frac{32}{3}\right) - \left(\frac{12}{12} \times 62.4 \times \frac{12}{12} \times \frac{1}{2} \times \left\{\frac{12}{3} + 20\right\}\right)\right] \times 4.25 =$

ABSOLUTE ULTIMATE 72,000 PSI.

1687 in lb/in. x 4.25 ft =

7170 in lb/pin > 7069 in lb

WILL FAIL @ 72 K/in.^{2}

DESIGN-CALCULATION CONT.
ROSS-COHEN DAM

AT FLOW LINE AT TOP OF DAM $M_{ACTING} = \left[\left(\frac{46}{12} \times 62.4 \times \frac{46}{12} \times \frac{1}{2} \times \frac{46}{3}\right) - \left(\frac{28}{12} \times 62.4 \times \frac{28}{12} \times \frac{1}{2} \times \frac{28}{3}\right)\right.$ [illegible]

$= 3166$ in lb/ft $\times 4.25$ ft

$= 13,455.5$ in lb/pin $>$ $\frac{60,000}{72,000}$ or

C.C. AT TOP OF DAM STRESS IN PINS WOULD BE
228% IF ULTIMATE WERE 60,000 PSI.
190% IF ULTIMATE WERE 72,000 PSI.

ON THE BASIS OF THE ABOVE THE PINS MAY BE EXPECTED TO FAIL AT A WATER LEVEL OF 29 TO 32 INCHES OVER SPILLWAY - C.C. AT A LEVEL OF 9 TO 12 OVER THE FLASHBOARD - WITH A FREEBOARD OF 19 TO 16 INCHES RESPECTIVELY REMAINING. AT ULTIMATE MAXIMUM CONDITION BEFORE FAILURE OF THE DAM THE STRESS IN THE PINS WILL BE APPROXIMATELY 200% OF THE ULTIMATE STRESS FOR THIS TYPE STEEL.

Jas C Clifton - J. PE

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: INDIAN MOUNTAIN LAKE County: MONROE State: PENNSYLVANIA

NDI ID No.: PA - 00783 DER ID No.: 45-227

Type of Dam: ZONED EARTHFILL Hazard Category: HIGH

Date(s) Inspection: 16 November 1979 Weather: WINDY - PARTLY SUNNY Temperature: 35°F

LIGHT SNOW ON GROUND

Pool Elevation at Time of Inspection: 1787.8 msl/Tailwater at Time of Inspection: 1787.1 msl

Inspection Personnel:

D. WILSON (GFCC) J. KUPPERT (OWNER - MAINTENANCE SUPERVISOR)

D. EBERSOLE (GFCC)

A. [illegible] (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	[illegible] EDGE OF [illegible] SLOPE [illegible] AT Spillway.	
CREST ALIGNMENT: Vertical Horizontal	[illegible]	
RIPRAP FAILURES	[illegible]	

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	JUNCTION OF EMBANKMENT AND SPILLWAY - [illegible] AND [illegible] SPILLWAY WALLS NEAR DRAINAGE.	
ANY NOTICEABLE SEEPAGE	[illegible]	[illegible]
STAFF GAGE AND RECORDER	[illegible]	
DRAINS	[illegible]	
VEGETATION	[illegible]	

E-21

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	[illegible] CONDUIT - NO [illegible]	
INTAKE STRUCTURE	[illegible]	
OUTLET STRUCTURE	HEADWALL [illegible] THROUGH [illegible] CRACKED) RIGHT [illegible] TILTED LEFT [illegible] MISSING	NO EVIDENCE OF [illegible] OPENING. LEFT SIDEWALL [illegible] LYING ABOUT 20' DOWNSTREAM
OUTLET CHANNEL	NO [illegible]	
EMERGENCY GATE	NO [illegible]	

B-1

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	FLOW [illegible] NO [illegible] DEFICIENCIES	
APPROACH CHANNEL	[illegible]	DRAIN HOLES IN APPROACH WALLS. CRACK IN RIGHT APPROACH WALL.
DISCHARGE CHANNEL	[illegible] HOLE [illegible] PUDDLES [illegible] IN APPROACH.	[illegible] behind WALL AT [illegible]. MINOR PEELING OF TOP OF WALLS IN SOME AREAS. SHRINKAGE CRACKS THROUGHOUT.
BRIDGE AND PIERS	[illegible]	
[illegible]	[illegible]	[illegible]

B-5

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None at Site	
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER	None at Site	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	NEAR [illegible] - NO DEBRIS [illegible]	
SLOPES	[illegible] AND VERY THICKLY [illegible] SCRUB BRUSH.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	11 HOMES observed [illegible] FLOODPLAIN.	1 OF THE dwellings UNDER CONSTRUCTION.

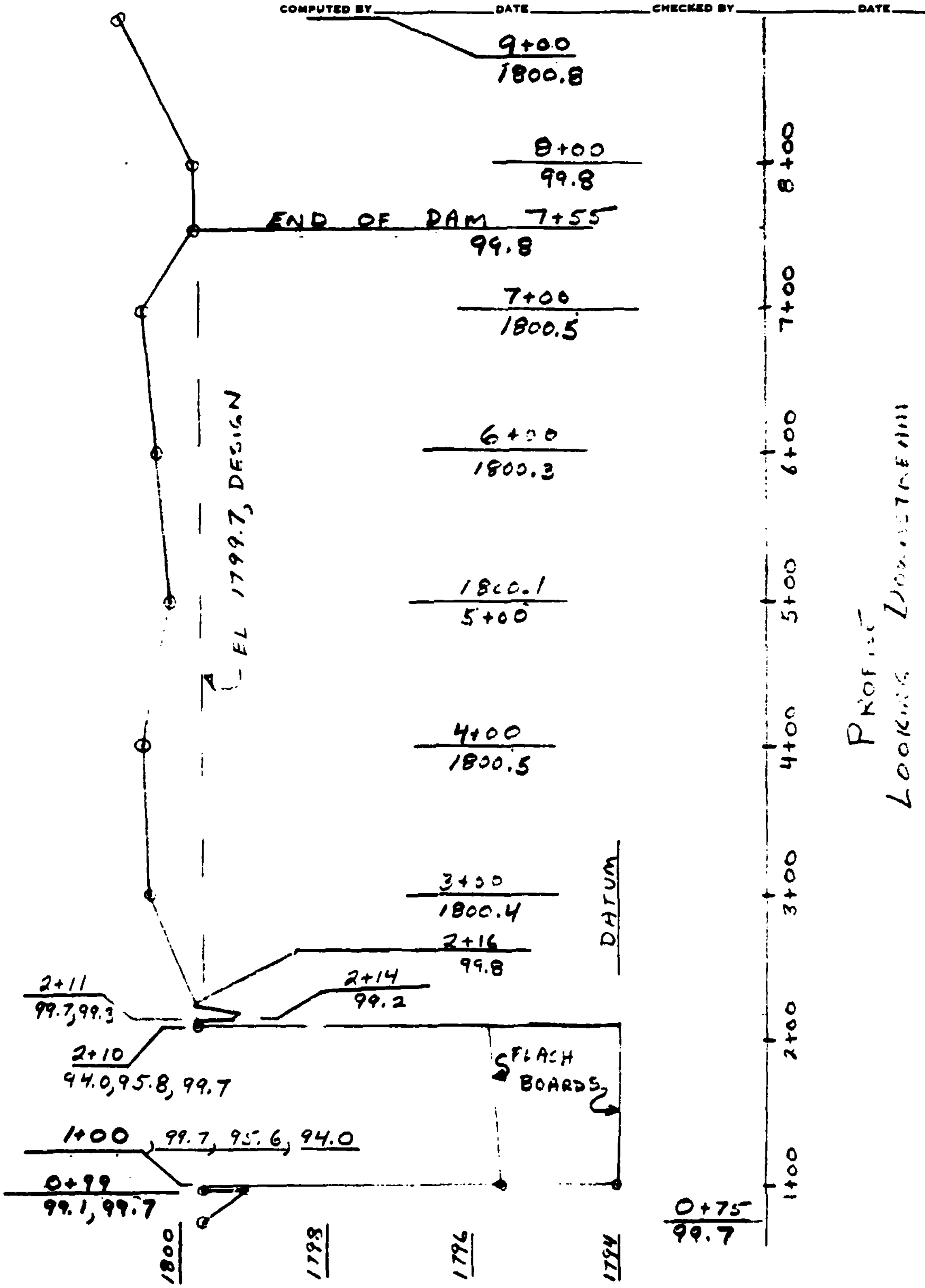
RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	VERY MILD	
SEDIMENTATION	NO [illegible] ON [illegible]	
WATERSHED DESCRIPTION	SWAMPY AREA [illegible] WITH SCRUB. MINOR [illegible]	

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

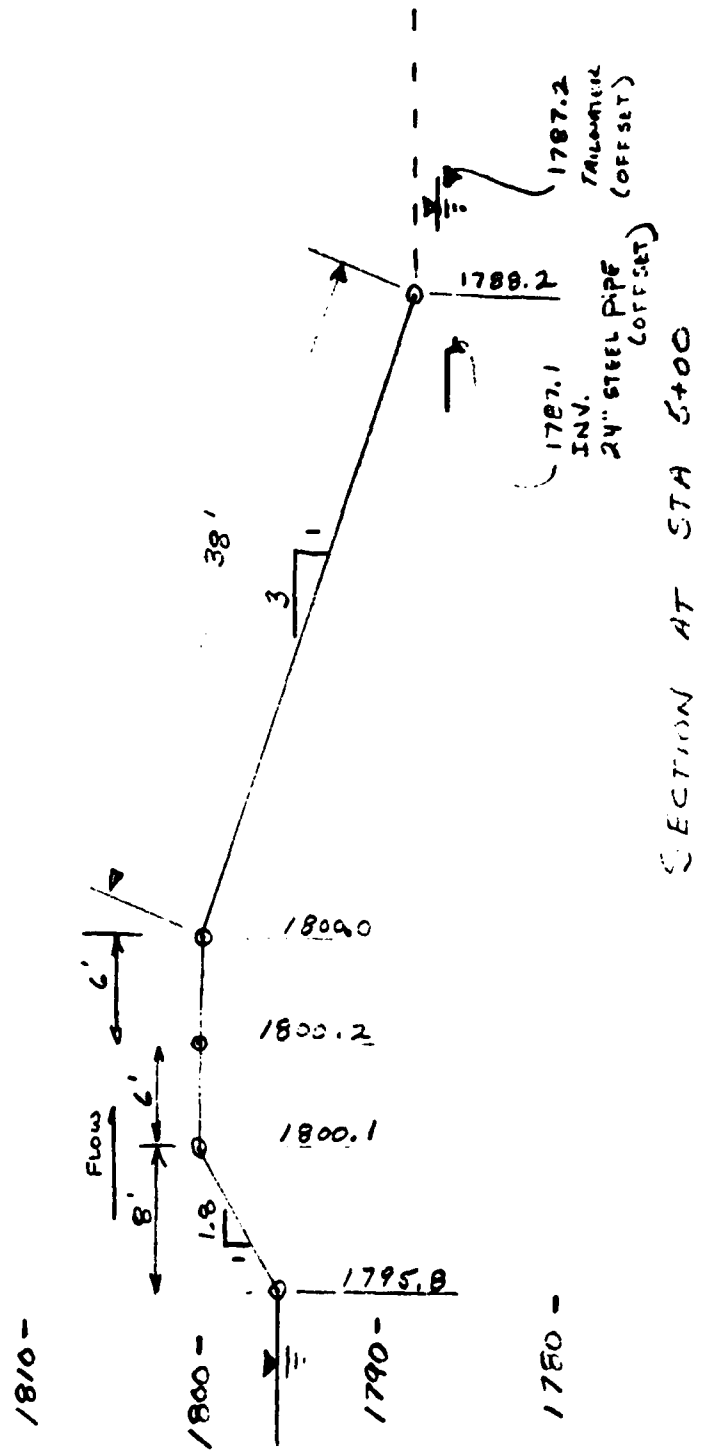
SUBJECT: INDIAN MOUNTAIN LAKE DAM FILE NO. ____
SHEET NO. ____ OF ____ SHEETS
FOR ____
COMPUTED BY ____ DATE ____ CHECKED BY ____ DATE ____



8313

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

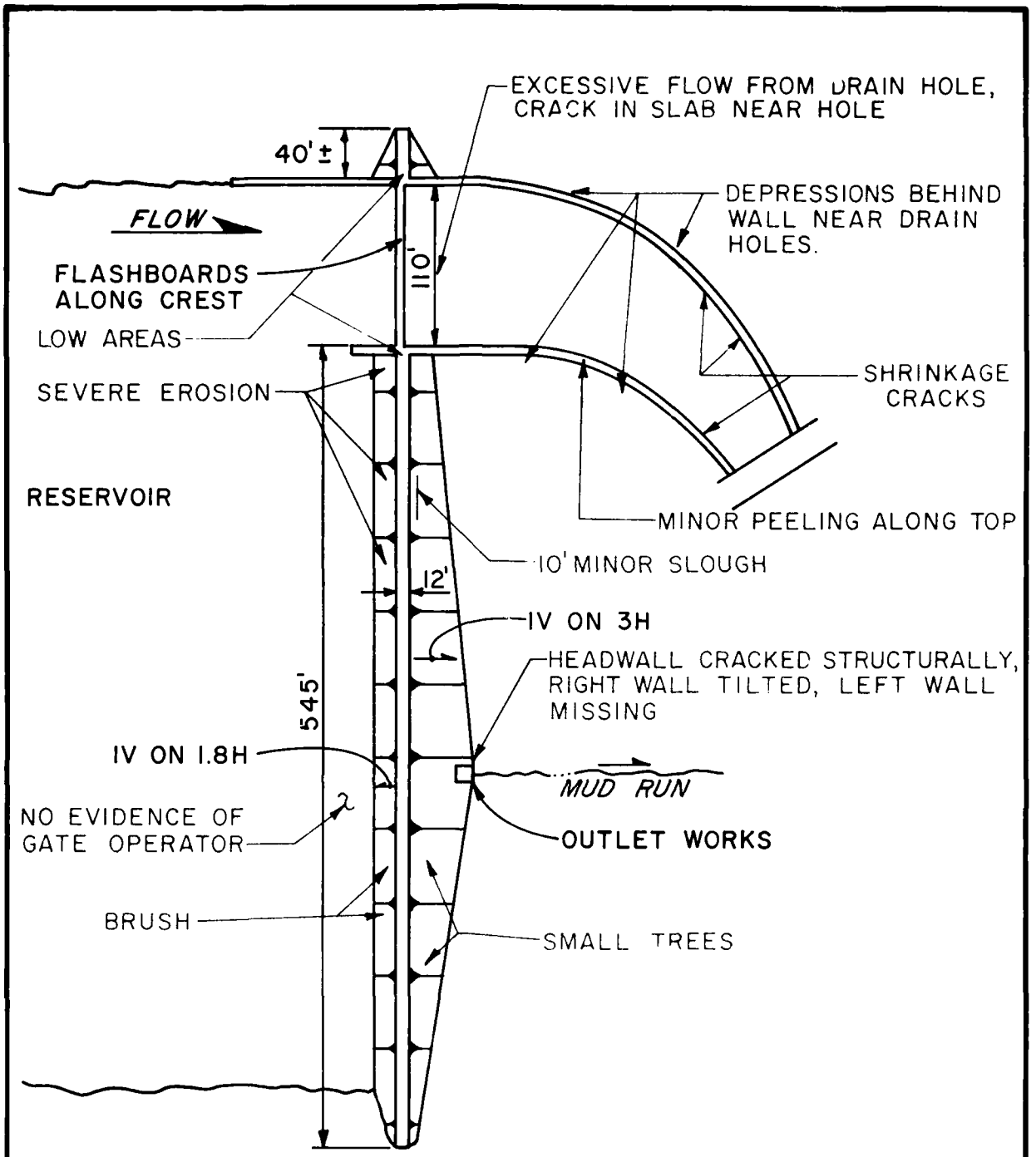
SUBJECT INDIAN MOUNTAIN LAKE DAM — FILE NO. — SHEET NO. — OF — SHEETS
FOR
COMPUTED BY — DATE — CHECKED BY — DATE



SECTION AT STA 5+00

B-10

0313



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

INDIAN MOUNTAIN LAKE DAM

INDIAN MOUNTAIN LAKES CIVIC ASSOC.

RESULTS OF VISUAL INSPECTION

JANUARY 1980 EXHIBIT B-1

APPENDIX C

PHOTOGRAPHS

INDIAN MOUNTAIN LAKE DAM

A. Downstream Slope

B. Top of Dam - Reservoir at Right

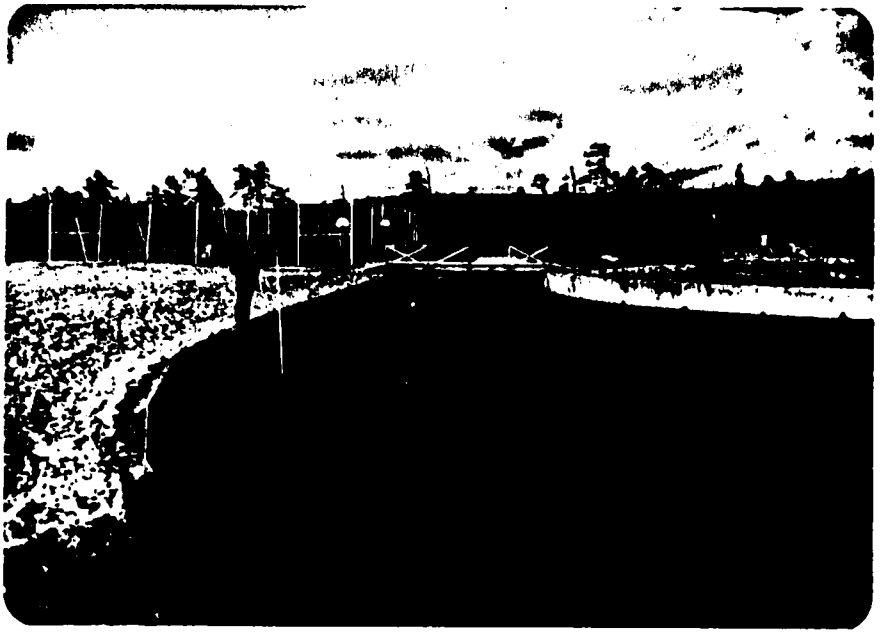
C. Upstream Slope

D. Right Abutment

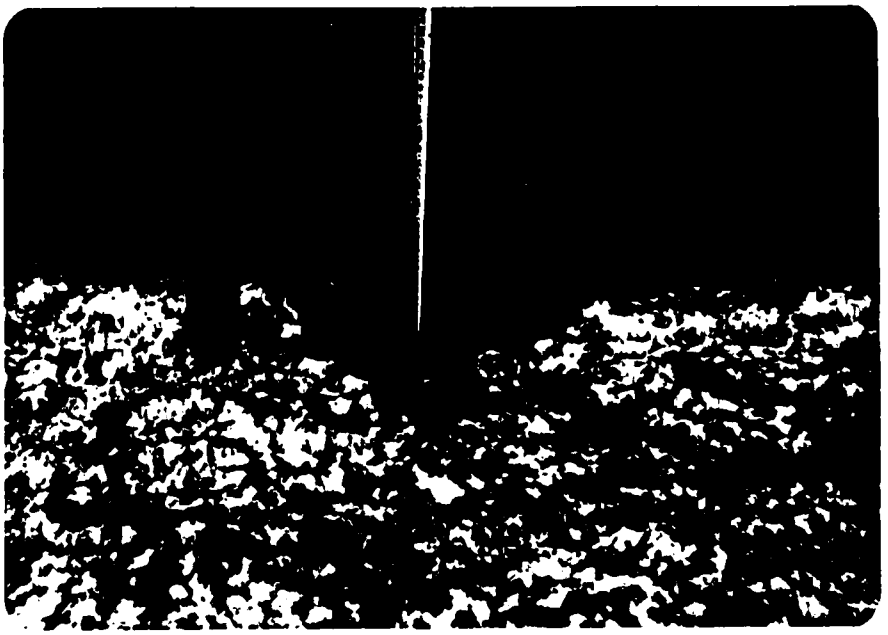
INDIAN MOUNTAIN LAKE DAM

E. Upstream Slope Near Spillway

F. Spillway



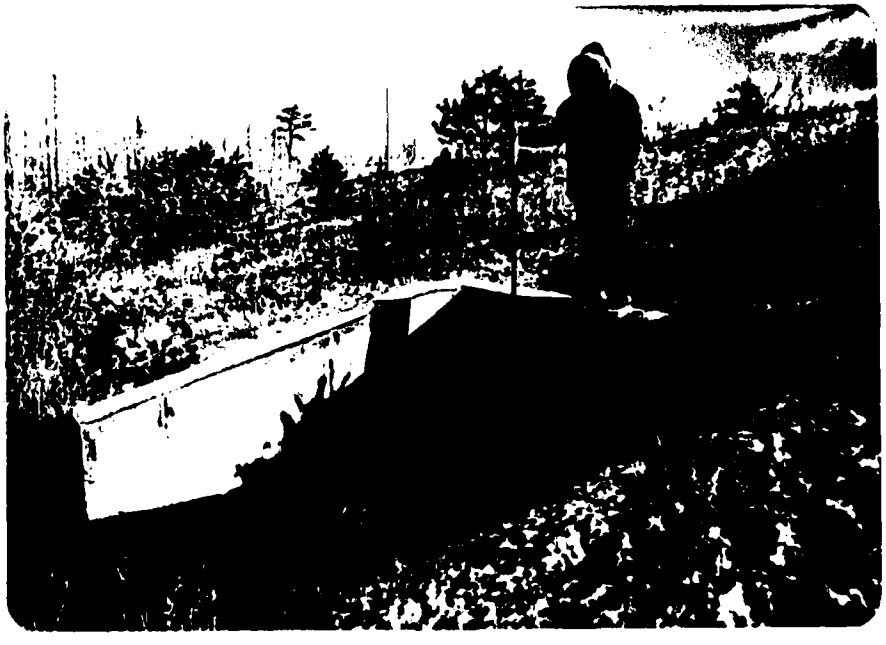
G. Spillway Outlet Channel



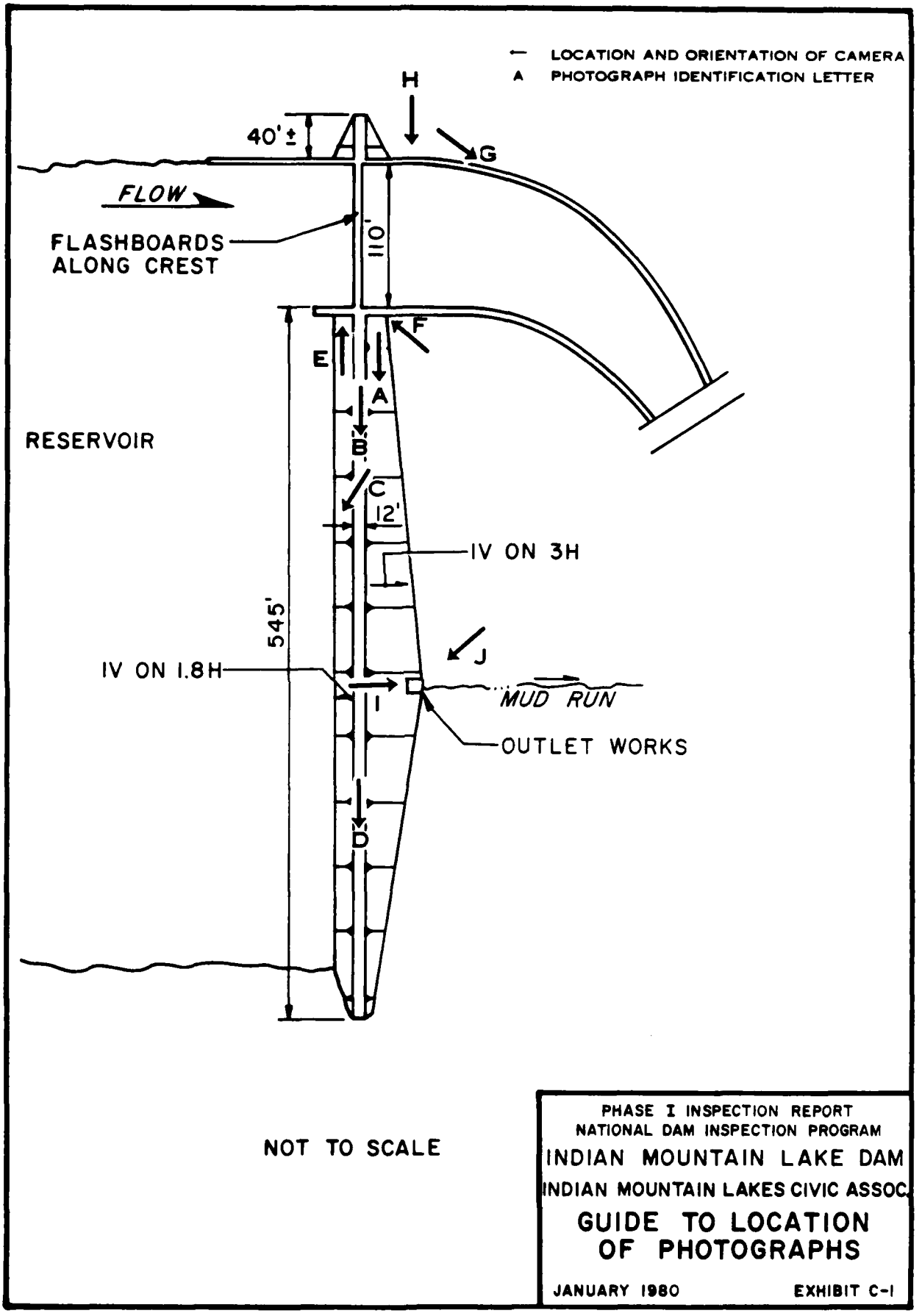
H. Typical Depression behind Spillway Wall

INDIAN MOUNTAIN LAKE DAM

I. Downstream Channel



J. Outlet Works Headwall



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

INDIAN MOUNTAIN LAKE DAM

INDIAN MOUNTAIN LAKES CIVIC ASSOC.

GUIDE TO LOCATION OF PHOTOGRAPHS

JANUARY 1980 EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

DELAWARE River Basin

Name of Stream: MUD RUN

Name of Dam: INDIAN MOUNTAIN LAKE

NDI ID No.: PA-00783

DER ID No.: 45-227

Latitude: N 41° 00' 15" Longitude: W 75° 30' 25"

Top of Dam Elevation: 1799.7

Streambed Elevation: 1787.1 Height of Dam: 13 ft

Reservoir Storage at Top of Dam Elevation: 840 acre-ft

Size Category: SMALL

Hazard Category: HIGH (see Section 5)

Spillway Design Flood: VARIES ½ PMF TO PMF
USE PMF BECAUSE OF DOWNSTREAM POPULATION

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
NONE				

DOWNSTREAM DAMS

NONE	(1 VERY SMALL IMPOUNDMENT			
	NOT CONSIDERED SIGNIFICANT			
	IN THE ANALYSIS OF THE			
	DAM)			

DELAWARE River Basin

Name of Stream: MUD RUN

Name of Dam: INDIAN MOUNTAIN LAKE

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A	2.84	0.45	2.1	2.803	1.174	N/A	3.00	2	B
Total	2.84								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.0 in., 24 hr., 200 sq. mile.

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.0

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	N/A
96 hours	N/A

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
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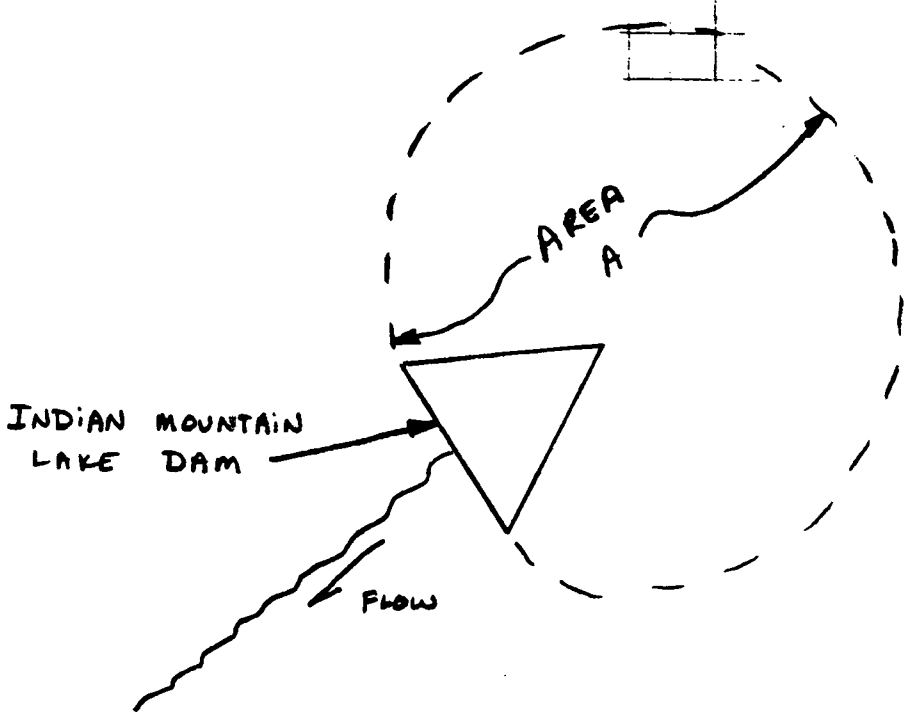
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



SKETCH
OF
SYSTEM
(ALSO SEE EXHIBIT D-1)

D018

Data for Dam at Outlet of Subarea A (See sketch on Sheet D-4)

Name of Dam: INDIAN MOUNTAIN LAKE

STORAGE DATA:

Elevation		Area (acres)		Storage million gals	Storage acre-ft		Remarks
1781.6	=ELEVO*	0		0	0		
1794.0	=ELEV1	49	=A1	66	203	=S1	SPILL CREST
1795.7		81			313		TOP FLASH*
1799.1		171			732		
1799.7		190			840		TOP DAM
1800.0	**	200					
1820.0	**	445					

* ELEVO = ELEV1 - $(3S_1/A_1)$ * NORMAL POOL, EXIST. CONDITIONS

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 4 percent of subarea watershed.

BREACH DATA: NOT USED

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: _____

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) _____ fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = _____ ft., C = ____ Top of Dam El.= ____

HMAX + Top of Dam El. = _____ = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = _____ ft (width of bottom of breach)
Z = _____ (side slopes of breach)
ELBM = _____ (bottom of breach elevation, minimum of zero storage elevation)
WSEL = _____ (normal pool elevation)
T FAIL= _____ mins = _____ hrs (time for breach to develop)

Data for Dam at Outlet of Subarea A (see Sketch on Sheet D-4)

Name of Dam: INDIAN MOUNTAIN LAKE

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	1799.1	1799.7
Spillway Crest Elevation		
Spillway Head Available (ft)		
Type Spillway	SEE FOLLOWING SHEETS	
"C" Value - Spillway		
Crest Length - Spillway (ft)		
Spillway Peak Discharge (cfs)		
Auxiliary Spillway Crest Elev.	NONE	NONE
Auxiliary Spill. Head Avail. (ft)	N/A	N/A
Type Auxiliary Spillway	N/A	N/A
"C" Value - Auxiliary Spill. (ft)	N/A	N/A
Crest Length - Auxil. Spill. (ft)	N/A	N/A
Auxiliary Spillway Peak Discharge (cfs)	N/A	N/A
Combined Spillway Discharge (cfs)		

Spillway Rating Curve*: SEE FOLLOWING SHEETS

Elevation	Q Spillway (cfs)	~~Q Auxiliary Spillway (cfs)~~	~~Combined (cfs)~~
1795.7	0		
1796.0	56	FLASH BOARDS INTACT	
1796.7	341		
1796.8	1819		
1798.0	3238	FLASHBOARDS WASHED OUT	
1799.0	4686		
1799.1	4840		
1799.7	5733		
1800.0	6192		
1805.0	15370		

* ONLY ACCURATE FOR RISING POOL CONDITIONS; THIS IS OK FOR DAM SAFETY ANALYSIS

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	1787.1		
Invert of Inlet	1788.5		
Type	STEEL PIPE		
Diameter (ft) = D	2		
Length (ft) = L	69		
Area (sq. ft) = A	3.14		
N	.012		
K Entrance	0.5		
K Exit	1.0		
K Friction=$29.1N^2L/R^{4/3}$	.73		
Sum of K	2.23		
$(1/K)^{0.5} = C$	0.70		
Maximum Head (ft) = HM	12.0		
$Q = CA\sqrt{2g(HM)}$(cfs)	61		
Q Combined (cfs)	≈ 60		

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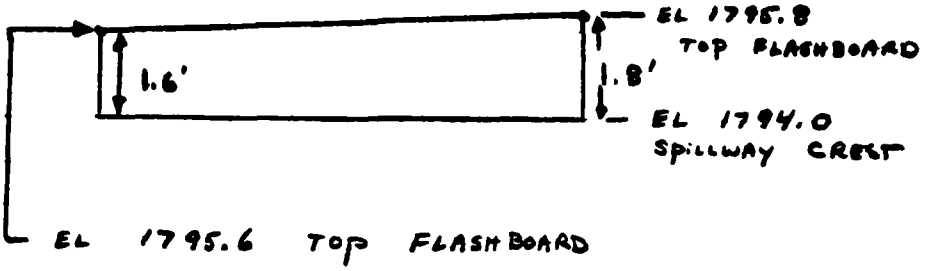
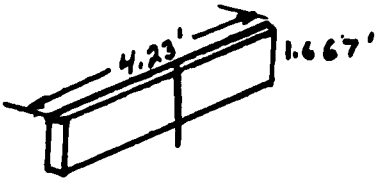
FLASHBOARD ANALYSIS
(SEE DESIGN COMPUTATIONS IN APPENDIX A)

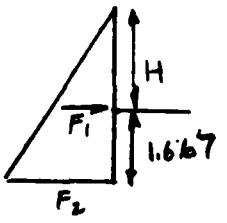


DESIGN HEIGHT OF FLASHBOARDS = 1.667'
DIFFERENCE IN HEIGHTS IS ROUNDOFF ERROR

REFERENCE APPENDIX A
USE 72,000 psi ULTIMATE STRENGTH
IN DESIGN A WIDTH OF 4.25'/pin
WAS USED
ACTUAL LENGTH OF 110'/26 pins
4.23'

MOMENT ON PIN AT FAILURE = 7069 in-lb
= 589 ft-lb





$F_1 = 62.4\ H$

$F_2 = 62.4\ (H + 1.67) = 62.4\ H + 104.208$

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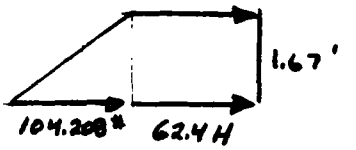
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



$M = 62.4H \times 1.667' \times 1.667'/2 \times 4.23$
$+ 104.208 \times 1.667/2 \times 1.667/3 \times 4.23$

$= 366.745\,H + 204.14$ Lb-FT

$589 = 366.745\,H + 204.14$
$384.86 = 366.745H \quad H = 1.049'$

ELEV AT FAILURE
$1795.67 + 1.049 = \underline{1796.7}$

BELOW EL 1796.7 - WEIR IS SHARP CRESTED
$C = 3.1$
ABOVE EL 1796.7 - WEIR IS SIMILAR TO KING "HANDBOOK OF HYDRAULICS" FIG 72
$C = aH + b$
$C = 3.18 + .126\,H$ MAX OF 3.83
$Q = CLH^{3/2} \quad L = 110'$

POOL	H(FT)	C	Q(CFS)	REMARKS
1794.0	0	—	0	
1795.7	0	3.1	0	FLASH BOARDS INTACT
1796.0	.3	3.1	56	
1796.7	1.0	3.1	341	
1796.8	2.8	3.53	1819	FLASH BOARDS WASHED OUT
1798.0	4.0	3.68	3238	
1799.0	5.0	3.81	4686	
1799.1	5.1	3.82	4840	
1799.7	5.7	3.83	5733	
1800.0	6.0	3.83	6192	
1805.0	11.0	3.83	15370	

SELECTED COMPUTER OUTPUT

8819

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
   1            A1                          DAM INSPECTION
   2            A2                             MUD RUN
   3            A3                          INDIAN MOUNTAIN DAM
   4            A      300       0      15       0       0       0       0       0      -4       0
   5            B1       5
   6            J        1       5       1
   7            J1     1.0      .9      .8      .7      .5
   8            K                1                                       1
   9            K1        RUNOFF INTO INDIAN MOUNTAIN LAKE
  10            M        1       1    2.84       0    2.84                               1
  11            P             22.0     111     123     133     142
  12            T                                                        1     .05             .04
  13            W      3.0    0.45
  14            X     -1.5   -0.05     2.0
  15            K        1       1                                       1
  16            K1        ROUTE THROUGH DAM
  17            Y                                1
  18            Y1       1                                         -1795.7      -1
  19            Y41795.7      1796  1796.7  1796.8    1798    1799  1799.1  1799.7    1800    1805
  20            YS       0      56     361    1619    3238    4686    4840    5733    6192   15370
  21            SA       0      49     200     445
  22            SE1781.6      1794    1800    1820
  23            SS1795.7
  24            SD1799.1
  25            SL       1       5      30     820
  26            SV1799.1  1799.2  1799.7    1805
  27            K       99
```

D-10

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS				
				RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .50
HYDROGRAPH AT	1	2.84	1	4412.	3971.	3529.	3088.	2206.
	(	7.36)	(	124.93)(	112.44)(	99.94)(	87.45)(	62.46)(
ROUTED TO	1	2.84	1	4003.	3611.	3204.	2831.	2087.
	(	7.36)	(	113.35)(	102.26)(	90.74)(	80.15)(	59.10)(

SUMMARY OF DAM SAFETY ANALYSIS

INDIAN MOUNTAIN LAKE DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1795.70	1795.70	1799.10
STORAGE	312.	312.	732.
OUTFLOW	0.	0.	4840.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1798.53	0.00	639.	4003.	0.00	44.00	0.00
.90	1798.26	0.00	599.	3611.	0.00	44.00	0.00
.80	1797.97	0.00	558.	3204.	0.00	44.00	0.00
.70	1797.66	0.00	516.	2831.	0.00	43.75	0.00
.50	1797.03	0.00	440.	2087.	0.00	43.50	0.00

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SUBJECT _____ FILE NO. _____

_____ SHEET NO. ____ OF ____ SHEETS

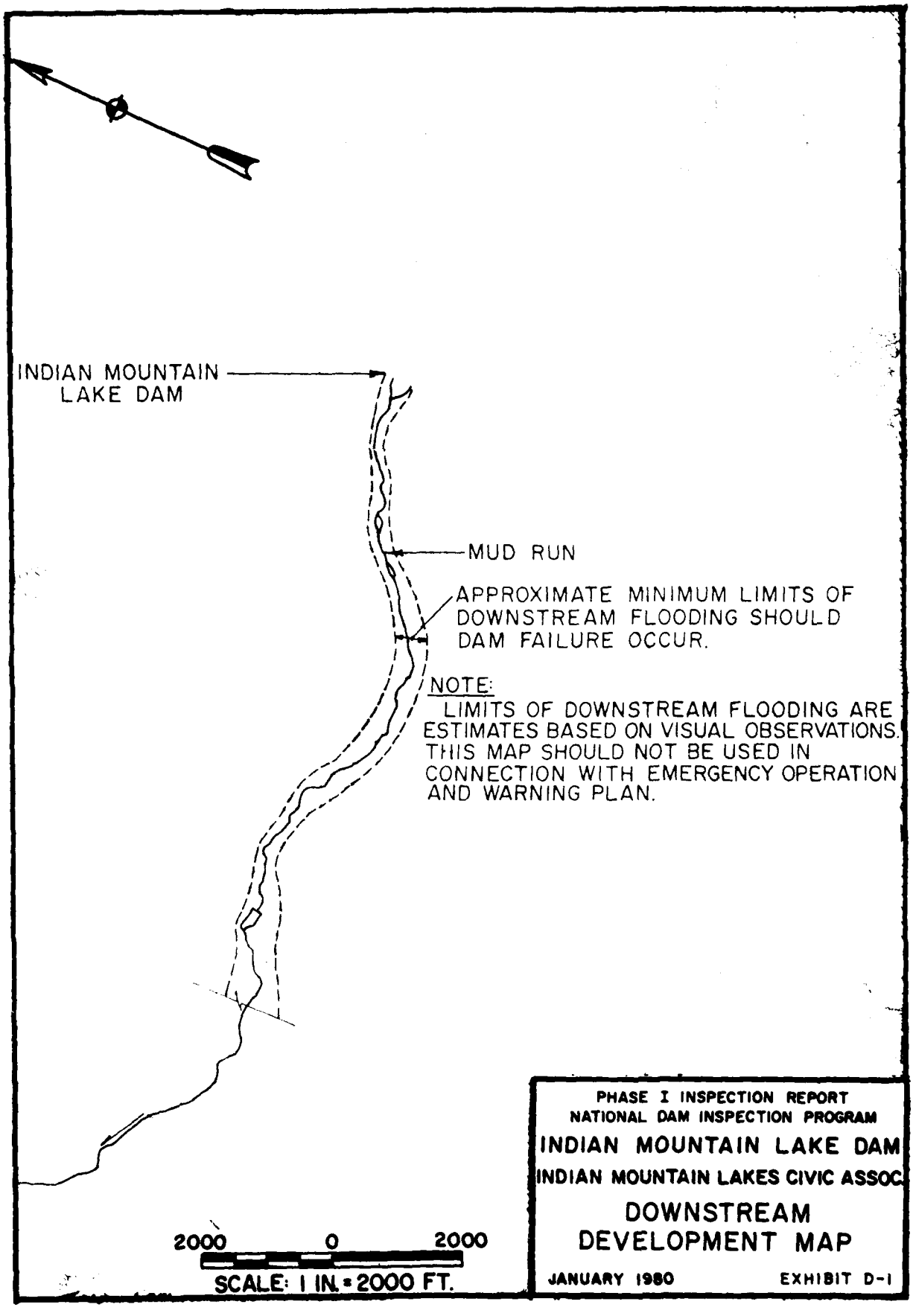
FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SUMMARY OF PERTINENT DATA

PMF RAINFALL = 25.0 INCHES

	PMF	½ PMF
RUNOFF (INCHES)	22.7	11.4
PEAK INFLOW (CFS)	4412	2206
PEAK OUTFLOW (CFS)	4003	2087
FREEBOARD (EXISTING CONDITIONS - FT)	0.57	2.07



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

INDIAN MOUNTAIN LAKE DAM

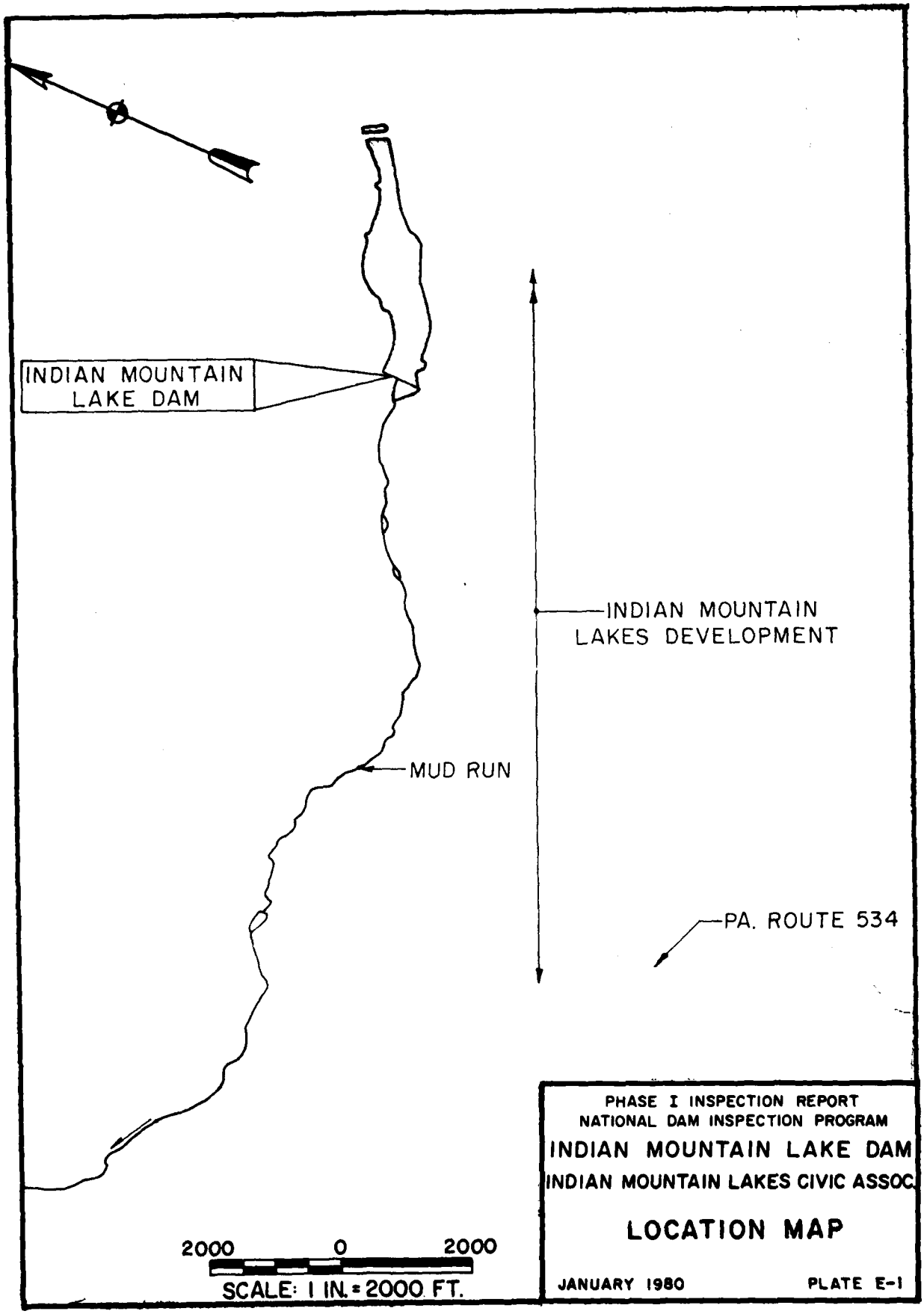
INDIAN MOUNTAIN LAKES CIVIC ASSOC.

DOWNSTREAM DEVELOPMENT MAP

JANUARY 1980 EXHIBIT D-1

APPENDIX E

PLATES



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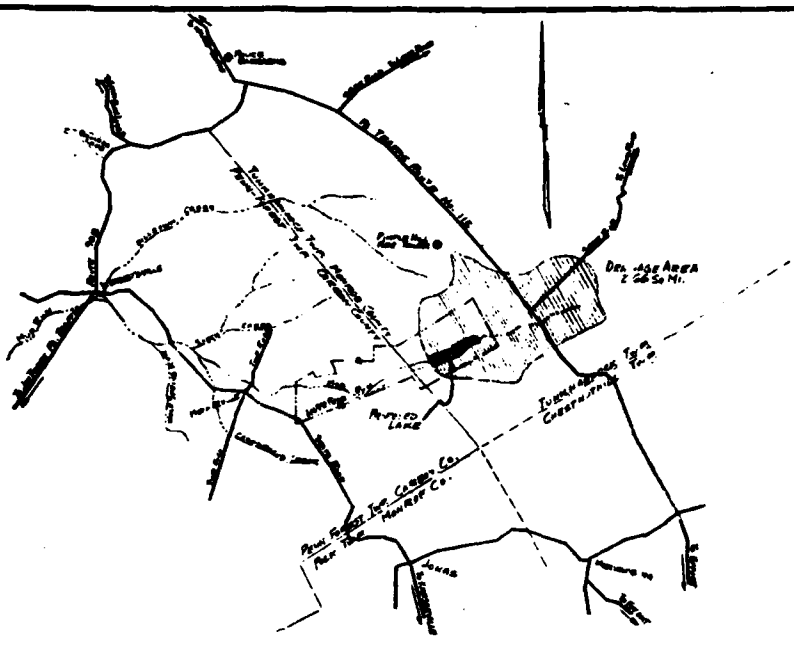
NATIONAL DAM INSPECTION PROGRAM

INDIAN MOUNTAIN LAKE DAM

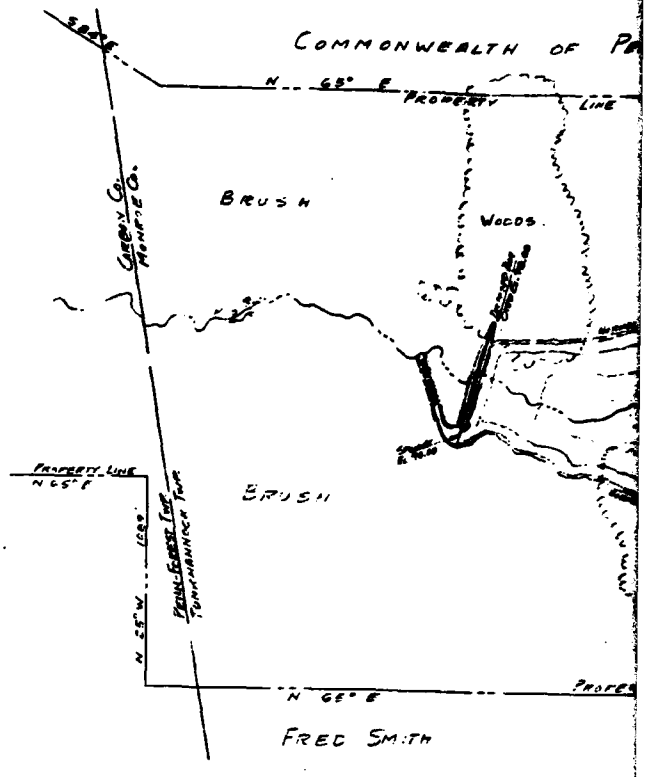
INDIAN MOUNTAIN LAKES CIVIC ASSOC.

LOCATION MAP

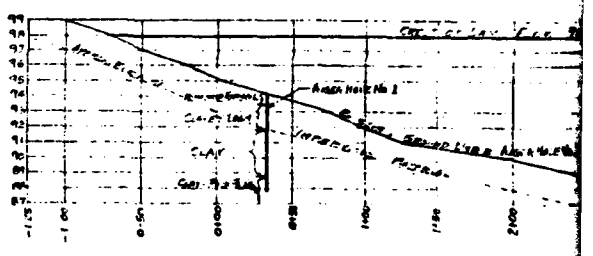
JANUARY 1980 PLATE E-1

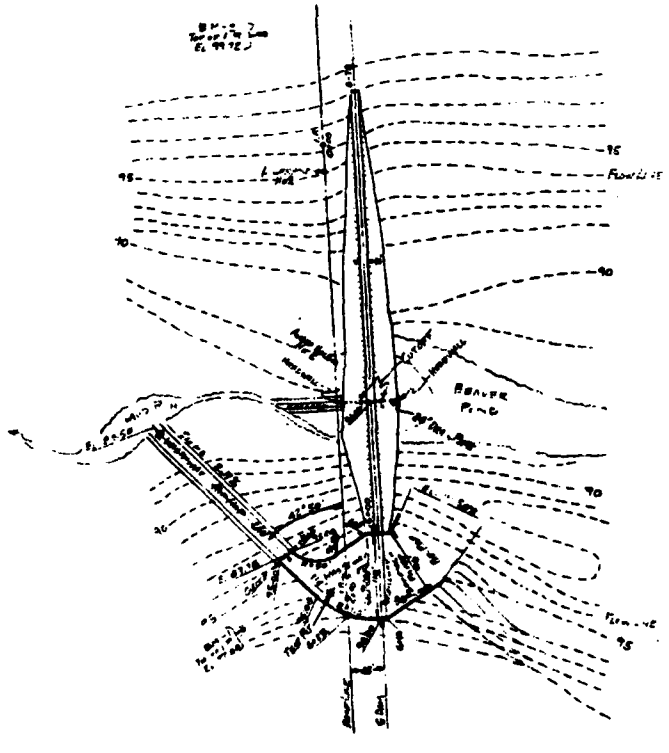


LOCATION PLAN
SCALE: 1" = 1 MILE

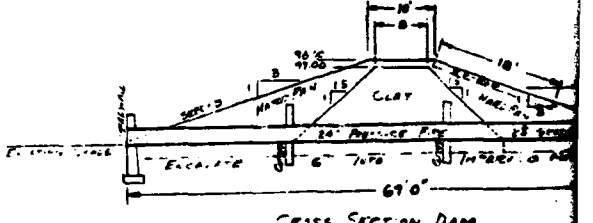


GEN
SCA

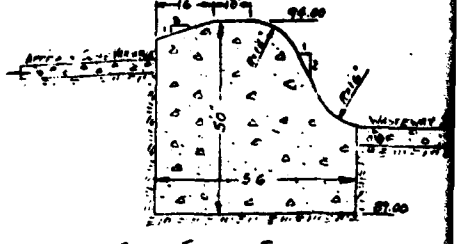




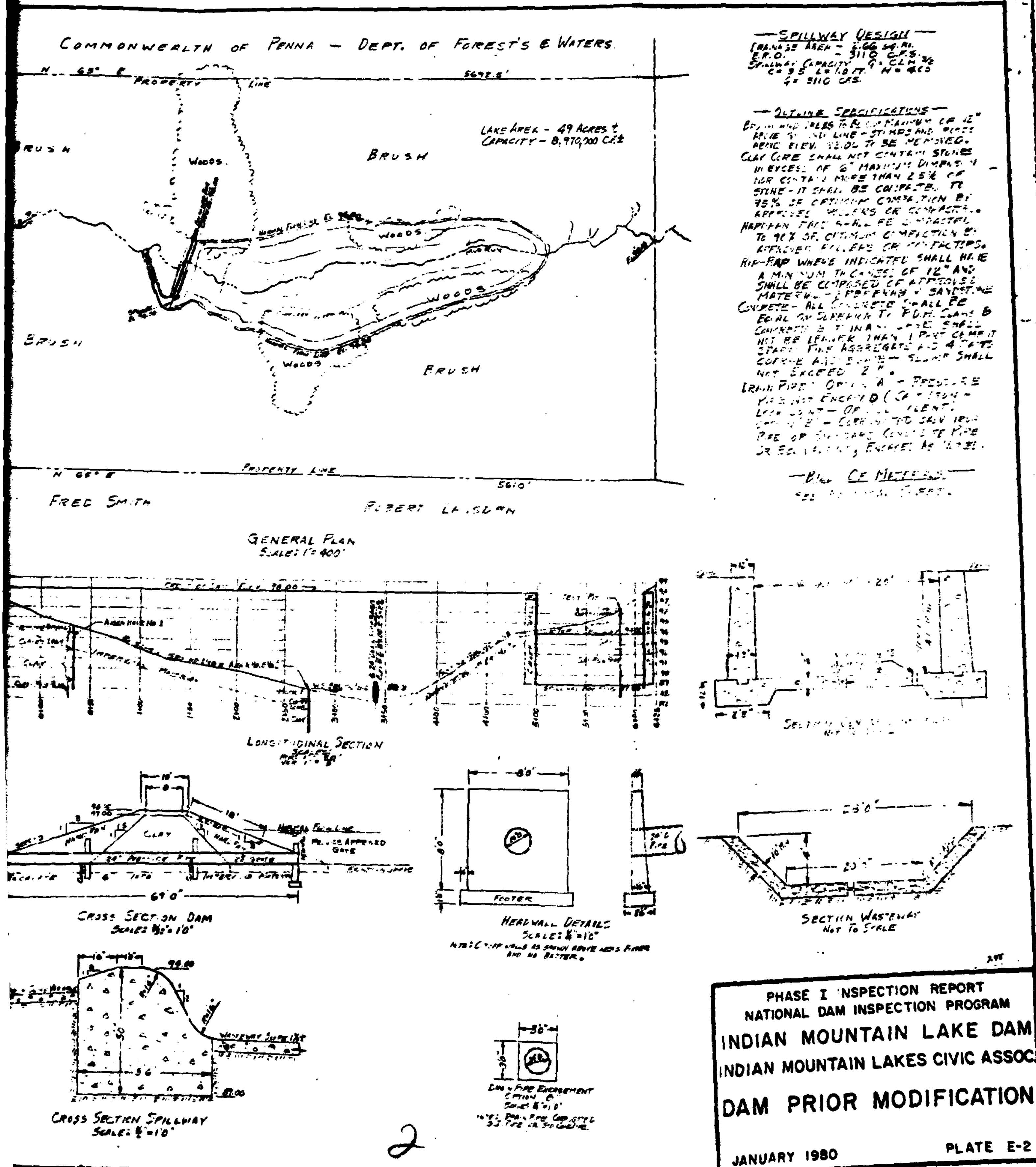
DAM AND SPILLWAY PLAN
SCALE: 1" = 100'
CONTOUR INTERVAL - 1 FOOT



CROSS SECTION DAM
SCALE: 1/32" = 1'0"



CROSS SECTION SPILLWAY
SCALE: 1/8" = 1'0"



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

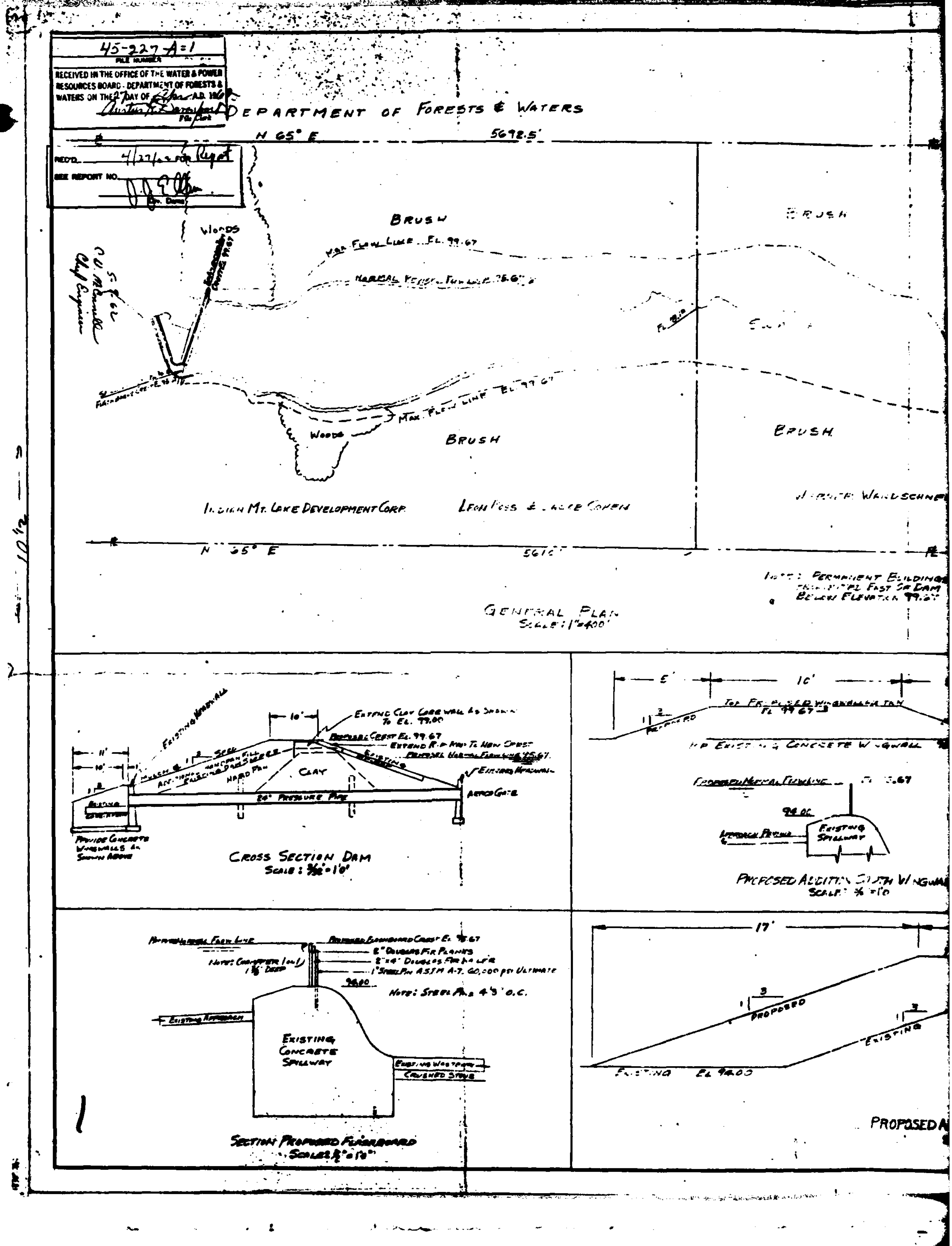
INDIAN MOUNTAIN LAKE DAM

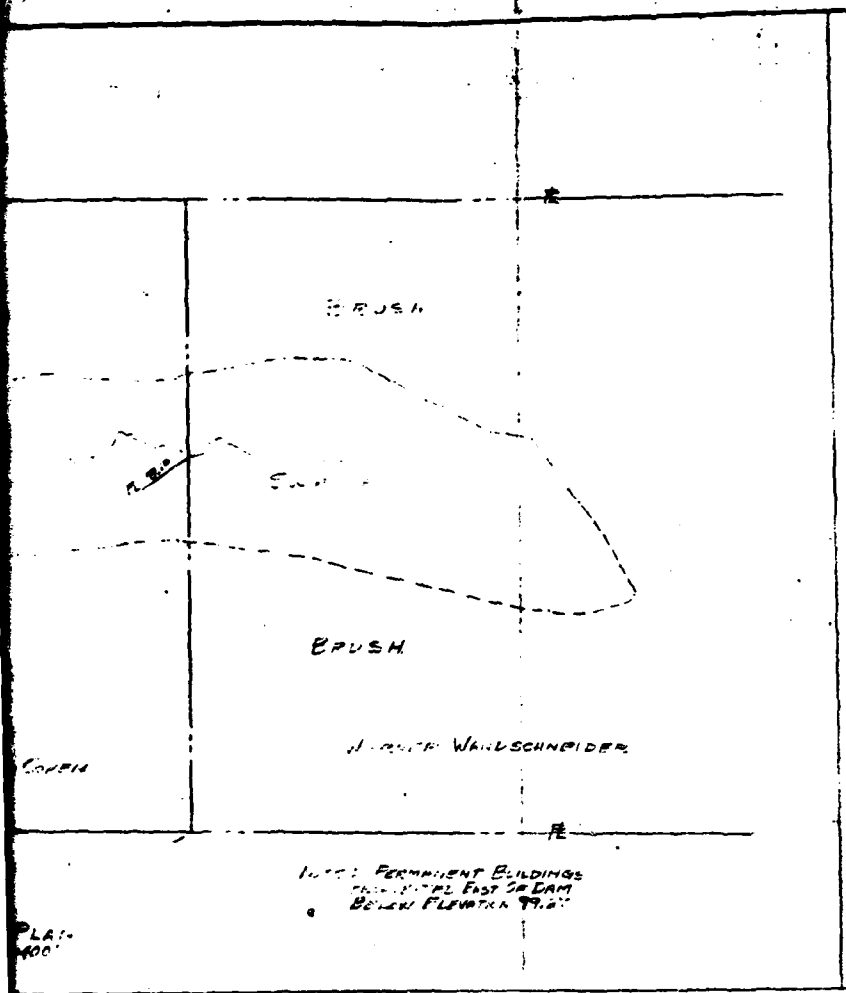
INDIAN MOUNTAIN LAKES CIVIC ASSOC.

DAM PRIOR MODIFICATION

JANUARY 1980

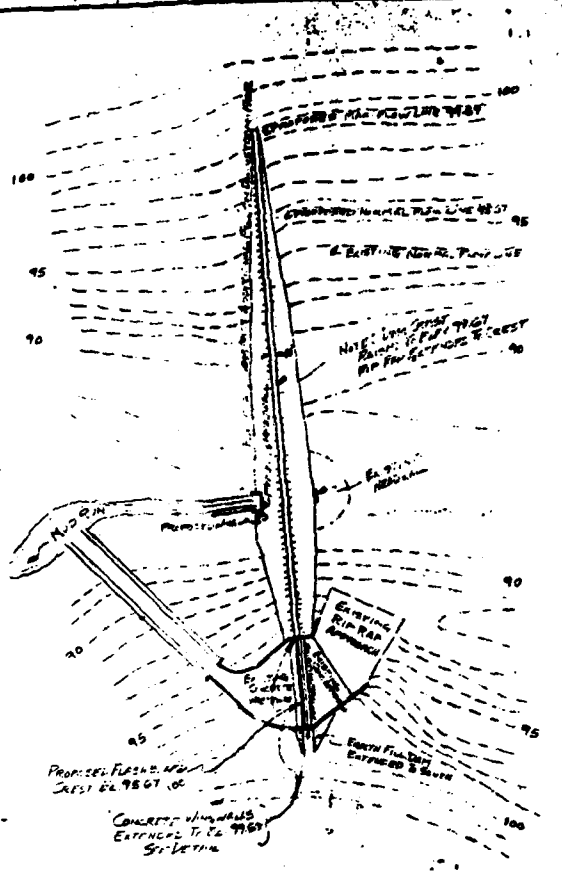
PLATE E-2


45-227-A-1
FILE NUMBER
RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD - DEPARTMENT OF FORESTS & WATERS ON THE 27 DAY OF
File Clerk
DEPARTMENT OF FORESTS & WATERS
N 65° E
5692.5'
REC'D. 4/27/ FOR Report
SEE REPORT NO.
BRUSH
WOODS
MAX. FLOW LINE EL. 99.67
NORMAL
MAX. FLOW LINE EL. 99.67
WOODS
BRUSH
BRUSH
BRUSH
INDIAN MT. LAKE DEVELOPMENT CORP.
N 65° E
GENERAL PLAN
CROSS SECTION DAM
10'
11'
CLAY
24" PRESSURE PIPE
PROPOSED CREST EL. 99.67
PROVIDE CONCRETE WINGWALLS AS SHOWN ABOVE
5'
10'
PROPOSED NORMAL FLOWLINE
94.00
EXISTING SPILLWAY
PROPOSED FLASHBOARD CREST EL. 95.67
2" DOUGLAS FIR PLANKS
NOTE: STEEL PINS 4'3" O.C.
EXISTING APPROACH
EXISTING CONCRETE SPILLWAY
CRUSHED STONE
SECTION PROPOSED FLASHBOARD
17'
PROPOSED
EXISTING
EL 94.00
PROPOSED A

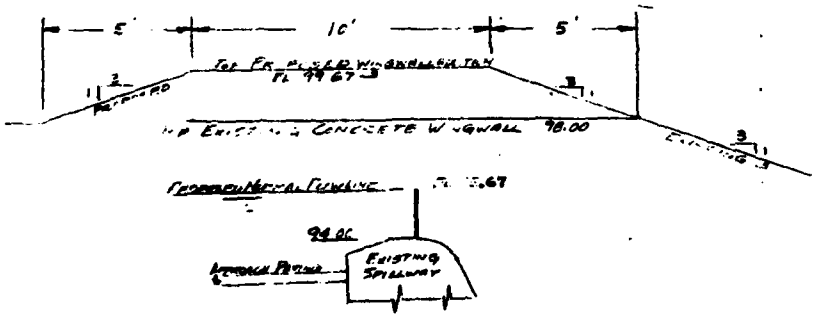


NOTE: PERMANENT BUILDINGS SHALL BE ABOVE FLOOD OF DAM BELOW ELEVATION 99.0'

PLAN
1"=100'

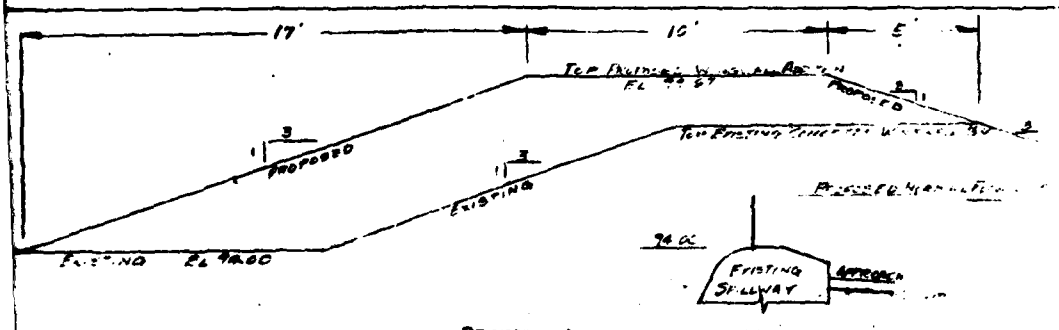


DAM AND SPILLWAY PLAN
SCALE: 1"=100'
CONTOUR INTERVAL - 1 FOOT



PROPOSED ADDITION SOUTH WINGWALL
SCALE: ⅜"=1'0"

NOTE: ... EL. TOP OF EXISTING WALL ... CLEAN THOROUGHLY ... SLURRY FOR BOND ... CUT KEY INTO WALL ... CONCRETE ... TYPE B.



PROPOSED ADDITION NORTH WINGWALL
SCALE: ⅜"=1'0"

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

INDIAN MOUNTAIN LAKE DAM

INDIAN MOUNTAIN LAKES CIVIC ASSOC.

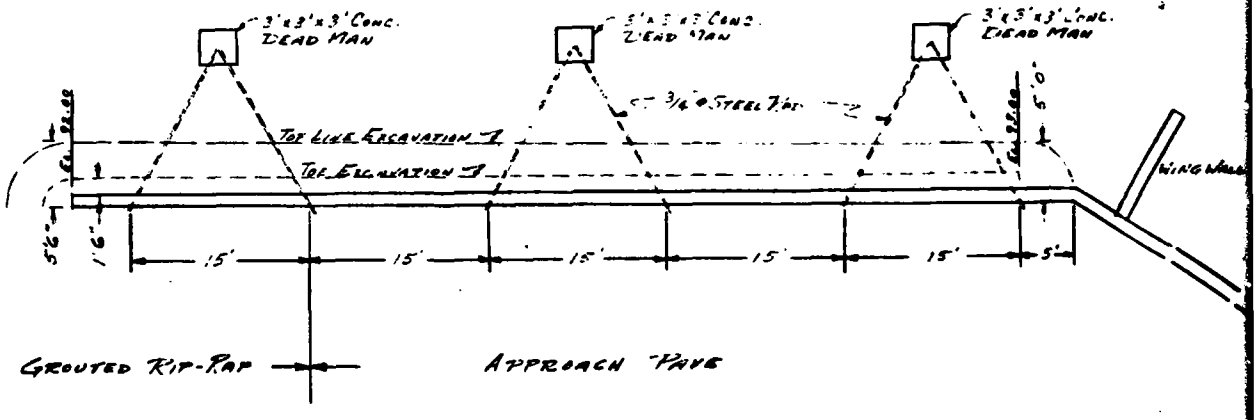
1962 MODIFICATION

JANUARY 1980

PLATE E-3

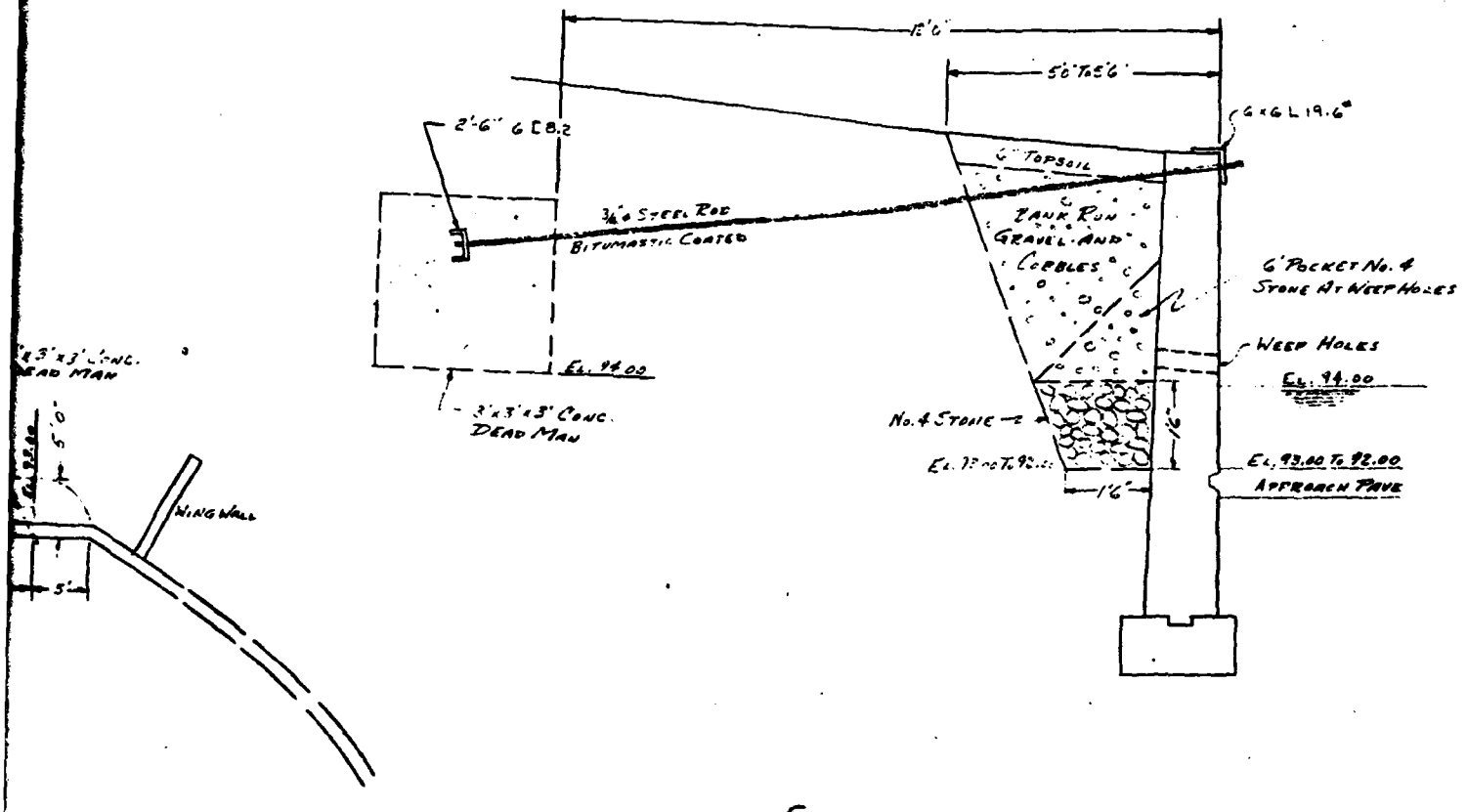
NOTES:

60 Cy. EXCAVATION
8 Cy. No. 4 STONE
40 Cy. BANK RUN GRAVEL & COBBLES
10 Cy. TOP SOIL
3 Cy. 1:2:4 CONCRETE
6 - 3/4" ϕ x 20' THREADED STEEL ROD
85 LIN. FT. 6 x 6 19.6# ANGLE
3 - 6 [8.2 x 2'



PLAN
SCALE 1" = 10'-0"

PROPOSED BACK
APPROACH WING
INDIAN MOUNTAIN
INDIAN MOUNTAIN L
TUNKHANNOCK TWP. M
SCALE AS NOTED 19
L. A. ACHTERMA
EAST STROUDSBU



SECTION
SCALE 1" = 2'0"

PROPOSED BACKFILL
APPROACH WINGWALL
INDIAN MOUNTAIN DAM
INDIAN MOUNTAIN LAKE DEVEL. CORP.
HAMILTON TWP. MONROE CO. PA.
AS NOTED 19 NOV. 1964
L. A. ACHTERMAN, JR. P.E.
EAST STROUDSBURG, PA.

2

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
INDIAN MOUNTAIN LAKE DAM
INDIAN MOUNTAIN LAKES CIVIC ASSOC.
1964 MODIFICATION DETAILS
JANUARY 1980 PLATE E-4

APPENDIX F

GEOLOGY

INDIAN MOUNTAIN LAKE DAM

APPENDIX F

GEOLOGY

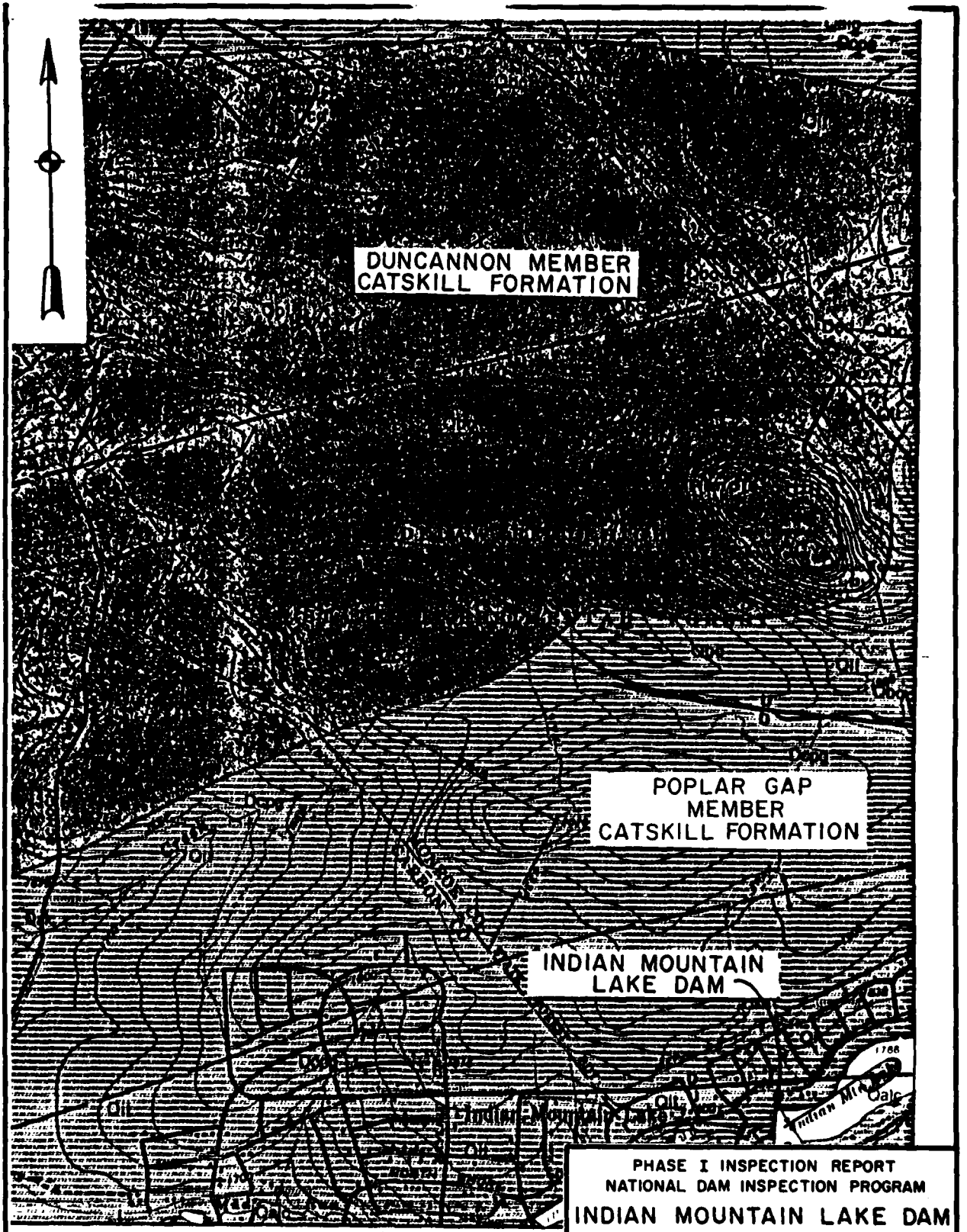
The Indian Mountain Lake Dam is located in Monroe County. The western half of the County lies within the Pocono Plateaus section of the Appalachian Plateaus Province and is separated from the Glaciated Low Plateau section of the same province by the Pocono Plateau Escarpment. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Escarpment. The greatest relief along the escarpment is 1,000 feet, which occurs at Camelback Mountain. The escarpment has a well-defined southwestward trend from Camelback Mountain but is more irregular between Camelback and Mount Pocono, which lies to the north. Streams east of the escarpment drain directly into the Delaware River, while those to the west drain to the Lehigh River.

Indian Mountain Lake Dam is located in the Pocono Plateau Section of the province. The Pocono Plateau is relatively flat, with local relief seldom exceeding 100 feet. The topography is characteristic of areas that were glaciated during the Pleistocene Epoch; these characteristics include moraines, drumlins, eskers, kame terraces, glacial lakes and poor drainage, resulting in many swamps and peat bogs. The most striking glacial feature is the mile-wide, end moraine that crosses the Plateau north of Interstate 80.

Indian Mountain Lake Dam is underlain by the Poplar Gap Member of the Catskill Formation. The Poplar Gap Member is predominantly a gray sandstone and conglomeratic sandstone with interbedded silstones and shales. Sandstones present are thick-bedded, fine-to coarse-grained, and exhibit very low, primary porosity due to a clay and silica matrix. Effective porosity results from fractures and parting planes. Conglomeratic sandstone occurs primarily as concentrates of sub-round to round quartz pebbles. The siltstones and shales at the site are thin bedded and also have low porosity.

The rocks are well-indurated and generally are not susceptible to slope failure; however, the presence of well-developed bedding and joint planes will result in some rockfall from vertical and high-angle cut faces.

The bedrock is entirely overlain by glacial till of Late Wisconsin Age. This till is basically an unsorted mixture of clay, silt, sand, and gravel. It is moderately cohesive and is generally derived locally from the sandstones of the Catskill Formation. Thickness of the till varies from 5 to 75 feet. The records of foundation exploration on Plate E-2 in Appendix E indicate the dam is founded on this till.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

INDIAN MOUNTAIN LAKE DAM

INDIAN MOUNTAIN LAKES CIVIC ASSOC.

GEOLOGIC MAP

JANUARY 1980 EXHIBIT F-1